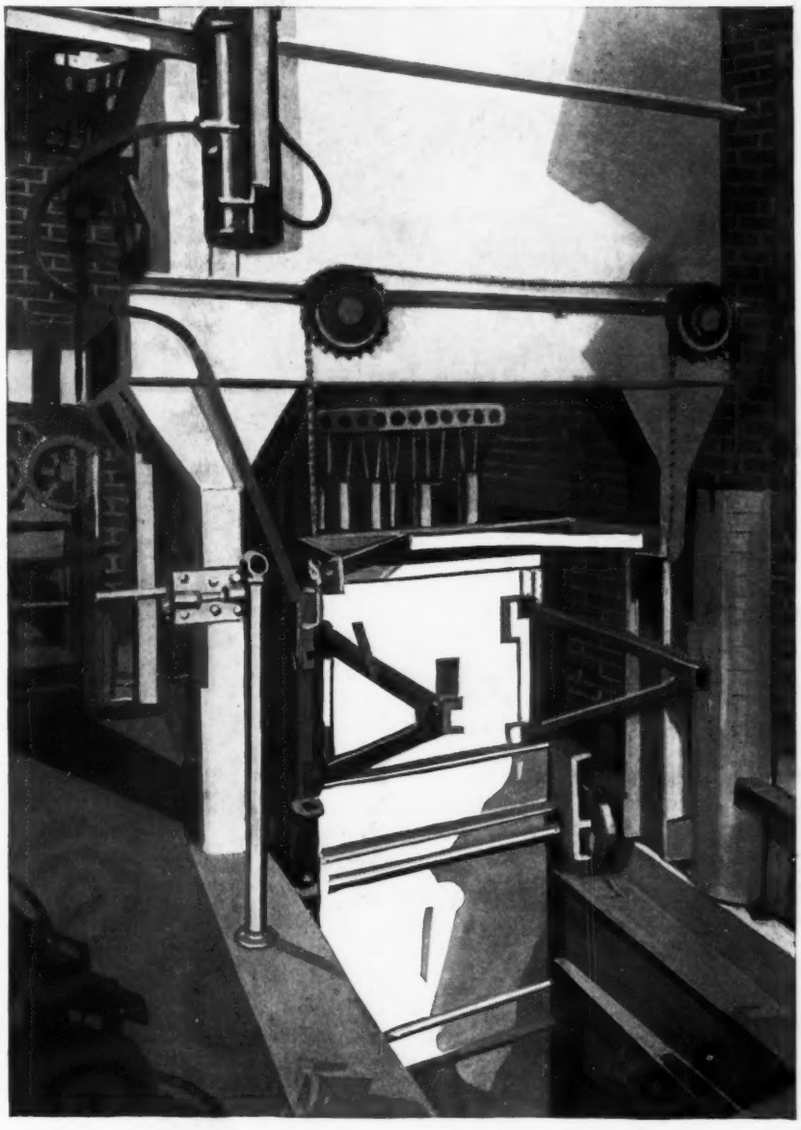
JAN 13 1930

ELECTRICAL WORLD



for the week
ending
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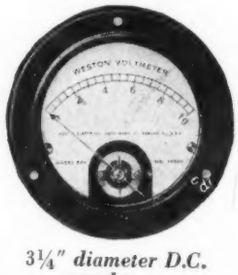

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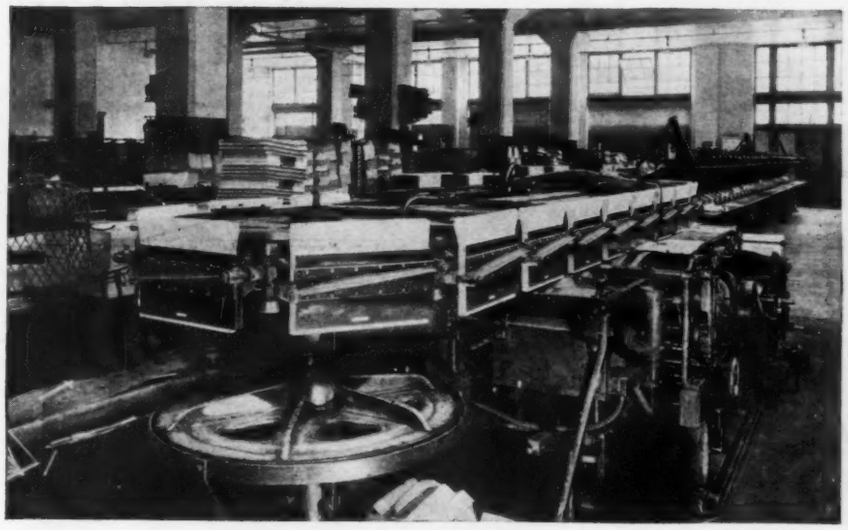

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January 11, 1930

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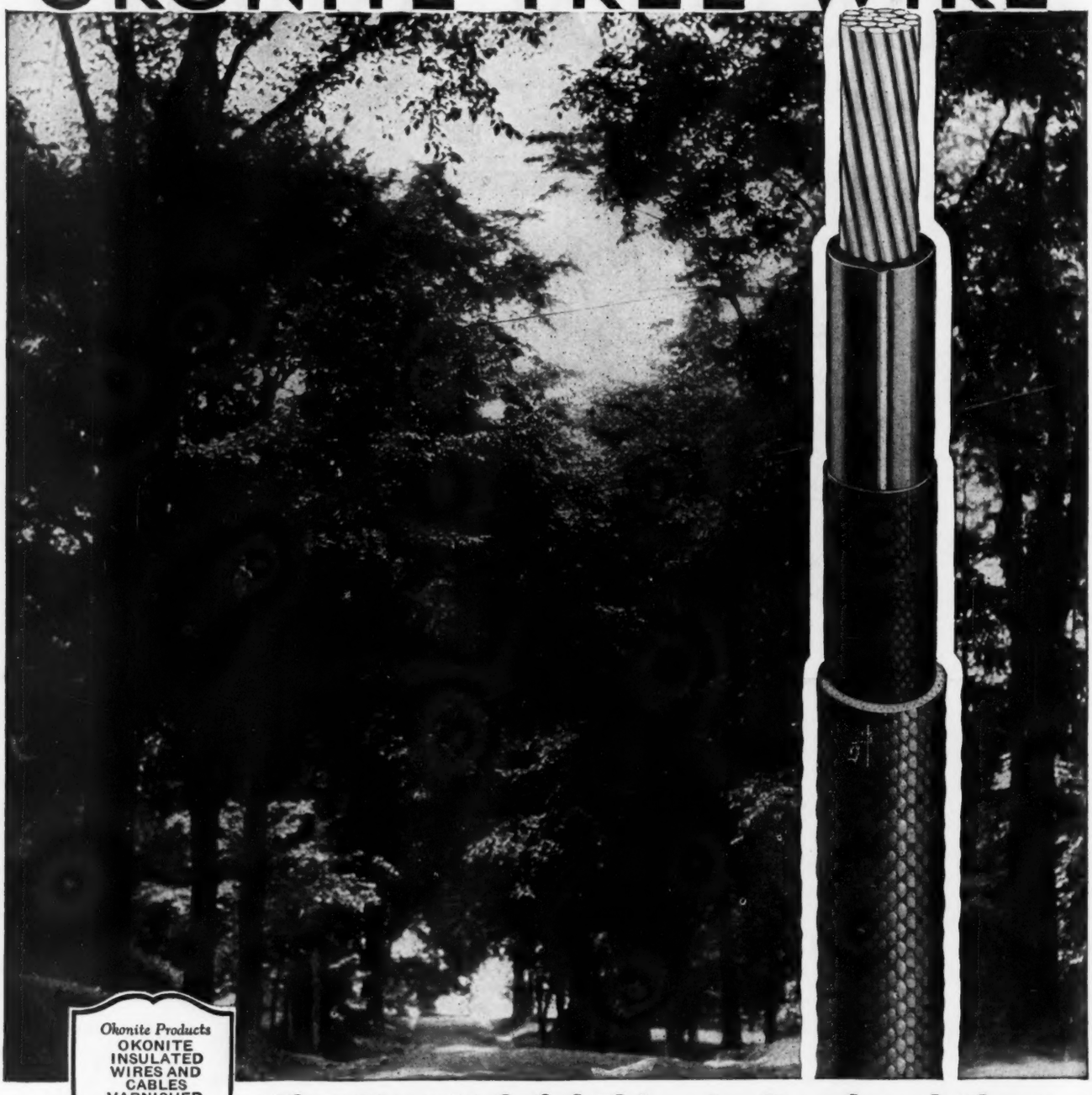

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ELECTRICAL WORLD

for the Week Ending

January 11, 1930

Editorial Comment On the News

UTILITY CORPORATE CHANGES continue. Five utilities merge their corporate identity to form the Commonwealth & Southern Corporation. This holding company will act as a directly responsible head for twenty subsidiary operating properties. As a contrast the new Standard Power & Light Corporation forms another holding company in a pyramid. It is to be expected, however, that this corporate structure will be simplified in the future, especially when expected corporate changes in eastern Pennsylvania territory are carried to completion.

UTILITY ASSOCIATIONS BEGAN to present testimony regarding the publicity phase of the Federal Trade Commission's investigation of the power and lighting companies when hearings were resumed on Wednesday. Rebuttals and surrebuttals are a familiar part of routine in courts of law. They do not seem to belong to an inquiry where ostensibly no one is in the dock and where the whole truth could have been elicited as the proceedings went along. Nevertheless, the commission's counsel having assumed the rôle of state's attorney from the very outset, it is gratifying that the putative defendants are at last to have a chance to tell their side of a distorted story.

SURPLUS IS A NECESSARY ASSET to a sound business. This is the opinion of the United States Supreme Court, rendered in the case of the United Railways & Electric Company versus the Maryland Public Service Commission. The court allowed a value for franchise and permitted depreciation to be computed on the basis of present costs. This decision is far-reaching in its application to utility rate cases and will arouse much expert comment.

TAX VALUES SHOULD BE rate-making values for public utilities in the opinion of the Conference of New York State Mayors, and it has recommended this and other utility law changes to the Governor and Legislature. If many more agencies issue edicts about the national utility problem, legislators will certainly have great freedom in their choice of a solution. Some time this country will awaken and put competent thinkers to work to determine the necessary and proper rules.

ELECTRICAL NEWS OF THE WEEK

Utilities Begin Rebuttal Testimony on Publicity and Propaganda

BEFORE the Federal Trade Commission on January 8, Bernard F. Weadock, special counsel for the utility associations, began presentation of the case for the utilities in relation to their publicity and alleged propaganda activities. Commissioner Edgar A. McCulloch presided, and Judge Robert E. Healy, chief counsel, represented the commission. Only documentary evidence was introduced, which, Mr. Weadock said, was for the purpose of clarifying and completing the record of the commission hearings to date.

In outlining the character of the evidence which he intends to present Mr. Weadock traced the history of the development of the power industry and invited the commission's attention to the economic straits in which the utility business found itself during and immediately subsequent to the war. It was at this time and during the period of reconstruction, he said, that the need became acute for the utilities to tell their story to the public.

By way of illustrating the situation, counsel read from correspondence between President Wilson, Secretary of the Treasury McAdoo and other government officials in 1918. With administrative approval a utilities committee was appointed to function in Washington so that full co-operation with the government might be effected. This was the body which afterward became the Joint Committee of National Utility Associations.

Mr. Weadock traced the development of 26 public utility information committees in 39 states as a direct consequence of the need of the utilities to reveal to the public their economic predicament during the early post-war years. Their credit had been impaired; their properties had been run down; their rates had not been increased commensurately with costs of essential materials and new construction and expansion. These committees, he said, for the most part functioned according to plan. Their work was well done and done openly and aboveboard. Their publicity material always bore the source of its origin clearly. He said that while a few individuals out of a quarter of a million employees in the utilities throughout the country have made mistakes in trying to tell the utility story, there is no evidence in the record to show that these errors in judgment or zeal were ever approved or countenanced by the industry as a whole.

In showing that utility activities in connection with schools and colleges had the sanction of the educational authorities, Mr. Weadock introduced extracts from more than 7,000 letters from school principals and school teachers requesting copies of pamphlets for school use and in many instances commending their contents. Mr. Weadock said that with trifling exceptions the pamphlets made available to the schools were non-controversial and were purely factual and technical in their context. A pamphlet on electricity, published by the National Electric Light Association and used in many states through the agency of public utility information committees, he introduced for the printed record, so that the public might judge whether or not it contained propaganda.

The conclusion reached by the N.E.L.A., through a committee, is, as interpreted by Mr. Weadock, that the introduction of outside material into the schools is prejudicial only when an attempt is made to foist it upon them without the teachers' supervision. The committee report reveals, he said, that in only four states is the use of such outside material restricted by law.

If the present program of the investigators is adhered to, the only witness called on to testify in defense of the alleged propaganda activities of the public utilities will be Preston S. Arkwright, president of the Georgia Power Company and president in 1929 of the N.E.L.A. Mr. Arkwright probably will be called on January 13 or 14.

SIOUX CITY G. & E. DECORATES

How central stations can add to holiday decorations by skillful use of a few hundred lamps was shown last month by the Sioux City Gas & Electric Company at its Big Sioux plant. Red, blue, green and amber 25-watt lamps made this valley station visible for miles

Lower Colorado Governors to Meet in Phœnix Soon

PHOENIX, Ariz., will be the meeting place of the Governors of Arizona, California and Nevada, who on January 20 will make still another effort to adjust their differences over water rights and Boulder Dam. If successful, Arizona's threatened recourse to the United States Supreme Court will be obviated. Secretary Wilbur of the Interior Department has announced that, regardless of the outcome of this conference, he will sign contracts for the sale of hydro-electricity as soon after February 1 as may prove possible.

▼

Columbia River Project Will Soon Be Under Way

THAT work on the first stage of the 200,000-hp. hydro-electric development at Rock Island on the Columbia River near Wenatchee, Wash., will be begun in the immediate future by the Puget Sound Power & Light Company, has just been officially announced by the Engineers' Public Service Company, of which the Seattle utility is a subsidiary. This will be the first major development to be constructed on this river and will ultimately cost about $15,000,000. The ultimate development can be increased, if demand makes it desirable, to 240,000 hp.

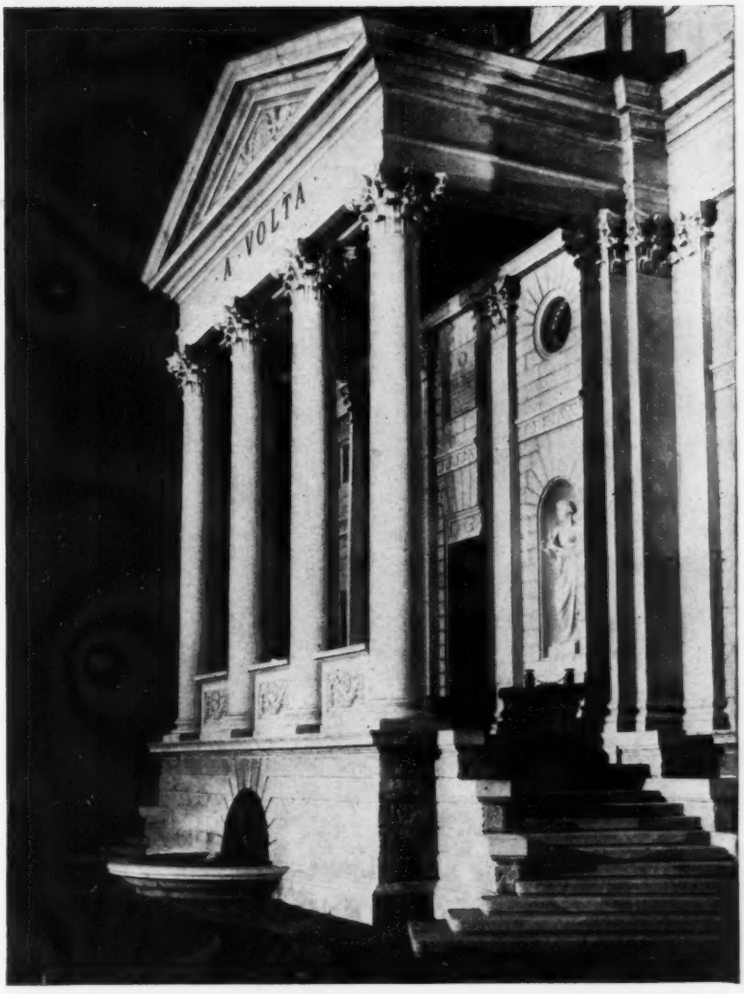
The dam will be about 60 ft. high and about 3,500 ft. long and will back up the water for 20 miles. Eighty thousand horsepower will be developed initially, and it will require more than two years to make this block of power available. Some of the power will be used locally, but the major portion will be transmitted 125 miles over the Cascade Mountains and distributed by the Puget Sound Power & Light Company's system. Contract for the design and construction of the project has been awarded to Stone & Webster Engineering Corporation.

▼

New York Legislature Marks Time on St. Lawrence

PRESS reports to the effect that the Republican leaders at Albany will still seek a way out from the deadlock on St. Lawrence River development were current this week. According to them, the party leaders contemplate changing their policy for an unbiased commission of investigation so as to permit Governor Roosevelt, if he concurs, to select its entire membership. The new commission would then investigate the Governor's plan for development along with such others as might be put before it, and the Republican party would pledge itself to support its recommendations. Just how likely this plan would be to commend itself to the Governor would, of course, depend on the wording of the resolution as regards qualifications or disqualifications for membership on the proposed commission. No resolution of the sort has yet been drafted for publication.

In the meantime some members of the Republican organization are restive over the situation — notably W. Kingsland Macy, a Long Island leader, who is assailing his party's tactics and declaring: "What the Republican party ought to do at this session of the Legislature is to dump the water-power problem right in Roosevelt's lap and say to the Governor, 'Go ahead and solve it.'"



ITALY HONORS A GREAT PIONEER

The beautiful memorial erected at Como, Italy, to Alessandro Volta, now floodlighted, attracts much admiration from tourists at night as well as in the day.

Engineering Foundation Succeeds United Society

ENGINEERING FOUNDATION, Inc., has, by change of name only, succeeded the United Engineering Society. The latter, as is well known, was set up by four national societies, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, which therefore came to be known as the founder societies.

Objections had been voiced from time to time to the name "United Engineering Society," and experience for many years had demonstrated that this name caused misconception and other difficulties, since the organization is not a "society" in the usual conception of the word. Its functions will remain the same; only the name is changed.

All Degrees of Opinion on Regulation Elicited in New York Inquiry

FURTHER sessions of the investigating commission which is to report to the sitting Legislature on the New York Public Service Commission law were held in New York City on Thursday, Friday and Saturday last week. The possibility of a uniform method of establishing a rate base was considered at the first sitting, the two plans previously presented by Chairman Prendergast of the regulating body and Dr. John Bauer, a utility expert, respectively, being up for examination.

Neither of these plans was favored by any of the witnesses—Alfred Forstall, a consulting engineer; Public Service Commissioner Neal Brewster and Prof. Henry Riggs of the University of Michigan. Mr. Forstall objected to the prohibition of a service charge and took the position that rates should be regulated only within broad limits, the cost to the company, plus reasonable profit, forming the minimum rate allowed, and the value to the customer forming the maximum rate. Commissioner Brewster opposed the idea of a special people's counsel and said the corporation counsel of each community was the best official for the purpose. Professor Riggs said that original cost was the best basis for figuring valuation after a period of declining prices, but he preferred reproduction cost as a basis when prices have increased since the installation was made. Investments could be protected only through such a dual system, he maintained.

On Friday Morris L. Cooke of Philadelphia, who was the director of Governor Pinchot's "Giant Power" survey; Harold Evans, a former member of the Pennsylvania Public Service Commission, and Alvin Reis, Progressive leader in the Wisconsin Assembly, were heard. All represented advanced points of view antagonistic to commission regulation as it exists. The first two thought the commissions overemphasize their judicial and neglect their administrative functions. They thought that the companies might be allowed to fix their own rate base if the commissions would control operating costs so that domestic consumers would not have to make up losses in the competitive power field. Mr. Cooke favored dividing the regulating bodies' functions into three—judicial, administrative and "master planning." Mr. Reis championed public ownership, supporting by statistics his contention that it would bring lower rates. On Saturday Dr. Bauer answered criticisms upon his plan of valuation.

At a session on January 8 D. Edgar Manson, president Rockland Light & Power Company, Nyack, N. Y., explained the status of Charles H. Tenney & Company as executive managers of the Rockland and other utilities, maintaining that the Tenney organization did not control them in the holding-company sense. Vernon M. Tallman, also of the Rockland company; Percy H. Johnson, consulting engineer, and Prof. W. C. Mitchell of Columbia University were other witnesses.

FAMOUS 220-KV. INTERCONNECTED SYSTEM

This effective map, reprinted from "Public Service News," shows the "inner ring" of the interconnected transmission system, planned for eventual operation at 220 kv., that will before long unite the Public Service Electric & Gas Company of New Jersey, the Philadelphia Electric and the Pennsylvania Power & Light

▼

New York Mayors Give Ideas on Commission Law

A SPECIAL committee of the New York State Conference of Mayors, acting for cities and first-class villages, has presented to the Governor and Legislature a report recommending that amendments for the following among other purposes be made to the Public Service Commission law:

To require the Public Service Commission to establish a bureau or division

adequately equipped to make appraisal of property of public utilities for rate-making and regulation purposes.

To extend the jurisdiction and powers of the commission to companies holding or controlling a substantial interest in public utilities by stock ownership or otherwise.

That the commission be given power to impose conditions in permitting abandonment of a franchise.

That the commission shall increase rates of public utilities only after hearing on notice to the municipalities affected.

That reports by public utilities to the commission show separately receipts of the utility in each municipality.

That property values reported by public utilities for tax purposes be presumptive evidence of value of the same property for rate-making purposes.

That municipalities shall have notice of and the right to become a party to all proceedings by the Public Service Commission affecting rates within the municipality.

▼

Massachusetts Governor on Buying City Plants

APPROVAL of the Department of Public Utilities should be obligatory before privately owned gas and electric companies purchase municipal plants, Governor Frank G. Allen of Massachusetts declared last week in his annual message to the State Legislature. The Governor asserted that the 43 municipal plants now operating in the Bay State have had an important influence upon private-company rates, and he intimated that the latter's rates should approach those of the municipal plants more closely.

At present the law allows private companies to purchase municipal plants without obtaining the commission's consent, but the board's approval is necessary to the purchase of one company by another. The Governor cited the recent offer of the Boston Edison company of $600,000 for the municipal electric plant and system of Concord.

▼

President May Sign Shoals Bill with Major Changes

NO REPLIES had been received on Wednesday to the invitation of the military affairs committee of the House of Representatives calling for bids on Muscle Shoals. The committee will wait until January 15 before giving further consideration to Muscle Shoals legislation. The offer of the American Cyanamid Company still is before it, but the impression is that it will not be altered to an extent that would make its passage probable.

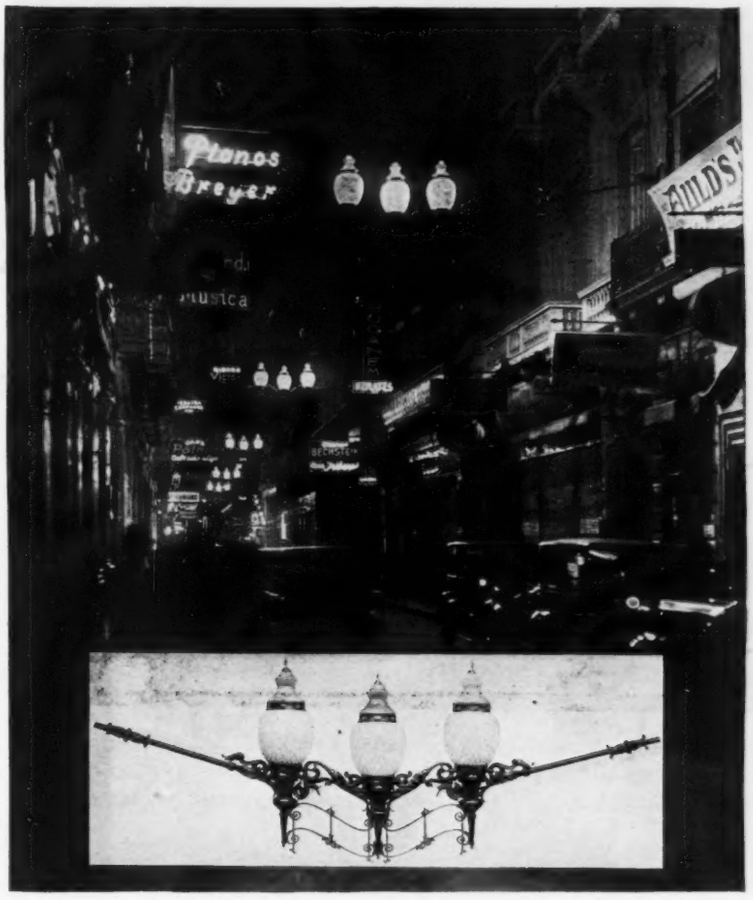
A letter from the Secretary of Agriculture recently made public is thought to set forth the administration's position. "The operation of the government nitrate plants," he says, "can be of little, if any, material value to the farmer. Therefore, if the property is to be applied to the benefit of agriculture some other means must be used. There is a need for the improvement of fertilizers, fertilizer practice and soil management. It is, therefore, recommended that the Muscle Shoals property be utilized as a source of revenue which will be applied to this end."

The foregoing statement, when considered in connection with the President's recommendation in his message to Congress "for investigation and experimentation on a commercial scale in agricultural chemistry," makes it apparent that the administration will oppose any plan that sets up the government in the business of producing fertilizers or power. It is desired, however, to use revenue from Muscle Shoals for thorough-going large-scale experiments with fertilizer materials.

If the Norris bill is altered so as to conform with that policy and so that the authorization for the construction of the Cove Creek dam is eliminated, it is believed the legislation will go through overwhelmingly and the signature of the President will be forthcoming.

Progress of Lighting in Argentine Republic

WHILE "Light's Golden Jubilee" was culminating on October 21 last in the ceremonies at Dearborn, Mich., electrical men of Argentina were marking the day by the inauguration of a permanent lighting exposition—the first in South America—in the National Industrial School at Buenos Aires. News and photographs of this exhibit just received from the Sociedad Argentina de Luminicultura, which conceived and carried out the plan, show booths devoted to displaying electric lamps of all types, the history of lighting, the relation of light to vision, industrial lighting, showcase lighting and so forth, the whole composing attractive and comprehensive "demonstration halls of light."



Buenos Aires is abreast of the day in her street lighting. Recently the society just named participated in the inauguration of the Florida Norte "white way." The illustration represents this avenue illuminated. One of the rows of three 2,000-volt ornamental units suspended at short intervals is shown beneath. Graceful standards bearing similar lamps in a cluster of three are also used.

NOW NEON TUBES FOR FLOODLIGHTING

Hot-cathode, low-voltage neon tubes are used in combination with ordinary projectors in floodlighting the Ferry Building tower at San Francisco. Pilasters on the upper offsets of the tower are neon-lighted in brilliant red

Hydro-Electric Plans in Four Provinces

CONSTRUCTION of another hydro-electric plant is planned by the Southern Canada Power Company. It will be built on the St. Francis River at Spicer Rapids, about 6 miles below Drummondville, Quebec, and will be capable of developing up to 50,000 hp.

The Ontario Hydro-Electric Power Commission is considering a new site on the Nipigon River, in northern Ontario, for power development. The site which may be selected is at Pine Portage, 12 miles up the river from Pine Falls. Here 100,000 hp. can be developed. At present 75,000 hp. is developed at Cameron Falls and in use. Another plant under erection at Alexander Falls, with 54,000 hp. capacity, will be ready to deliver power next fall, and with the projected development at Pine Portage, all this will place the Nipigon yield at 229,000 hp.

In order to provide an adequate supply of electrical energy for the Sudbury district, the Ontario Hydro is considering a new development at one of three possible sources of supply—the Ottawa, the Mississauga and the Abitibi—which will take care of this section's industrial and domestic needs for decades. Indications are that very large blocks of power will be needed from at least one or possibly more of these sources for the expansion of Sudbury's mineral areas. While the extent of the development to be undertaken has not been divulged by the commission, it is known that the district will be ready to use at least 50,000 hp. as soon as it is made available. All available power at present serving the district is in use or is about to be used.

Through an agreement just concluded between the government of Canada and the Province of Alberta, the big power site at Spray Lakes becomes the property of the province and any future development will rest entirely with it. Several years ago the Calgary Power Company prepared plans for the development of this site, which lies within the Rocky Mountain National Park, 65 miles west of Calgary. An upper plant with an effective head of 410 ft. and a lower plant with an effective head of 567 ft. were planned.

Vancouver, B. C., plans a survey of the city's huge power reserve at Cheakamus Falls. Engineers have declared that the city can develop and deliver power from there for half a cent a kilowatt-hour.

▼

Southern California Edison Program in 1930

INCLUDED in the Southern California Edison Company's construction budget of nearly $24,000,000 for this year are the completion of a second 100,000-kw. generating unit at its Long Beach steam plant (a third one is planned for 1931), completion of the La Fresa major substation between Torrance and Redondo Beach, expansion of the Laguna Bell substation, and extensions of great size to the company's transmission and distribution systems. Construction of new general offices in Los Angeles will be completed.

▼

Shawinigan Adds 162 Miles to High-Tension Lines

FOLLOWING closely on the inauguration of the Grand'Mère-La Tuque high-tension line of the Shawinigan Water & Power Company, reported on January 4, another of the company's lines connecting the Quebec terminal station, which receives its power from the Ile Maligne plant of the Duke-Price Power Company, on the Saguenay River, with Thetford Mines, has been placed in operation.

This 110-kv. single-circuit line is 55 miles long and is strung on 500 steel towers. A notable feature is the crossing over the St. Lawrence River, near the Quebec bridge. Another 110-kv. line nearing completion connects the company's terminal at St. Gregoire, south of Three Rivers, with Hemmings Falls, a distance of 33 miles. The Shawinigan company has added 162 miles of high-tension transmission line to its system since a year ago.

Depreciation to Be Figured on Present Value, Supreme Court Says

HOLDING that 7.44 per cent is not an excessive return on the present value of the property of the United Railways & Electric Company of Baltimore, the Supreme Court of the United States has decided in favor of that company and against the Public Service Commission of Baltimore in a case appealed by the company from an adverse decision of the Maryland Court of Appeals. The traction company desires to charge a flat fare of 10 cents; the commission had ordered it to sell four fare tokens for 35 cents and had declared 6.26 per cent an adequate return.

The Supreme Court held the commission's order to be confiscatory, saying:

There is much evidence in the record to the effect that in order to induce the investment of capital in the enterprise or to enable the company to compete successfully in the market for money to finance its operations, a net return upon the valuation fixed by the commission should be not far from 8 per cent. Since 1920 the company has borrowed from time to time some $18,000,000, upon which it has been obligated to pay an average rate of interest ranging well over 7 per cent. This has been the experience of street railways quite generally. . . . It is manifest that just compensation for a utility, requiring for efficient public service successful and prudent management as well as use of the plant, and whose rates are subject to public regulation, is more than current interest on mere investment.

Sound business management requires that after paying all expenses of operation, setting aside the necessary sums for depreciation, payment of interest and reasonable dividends, there should still remain something to be passed to the surplus account, and a rate of return which does not admit of that being done is not sufficient to assure confidence in the financial soundness of the utility to maintain its credit and enable it to raise money necessary for the proper discharge of its public duties.

Justices Brandeis, Holmes and Stone dissented. They took the view that the easement or franchise of the company, valued at $5,000,000, should be eliminated from the rate base and that depreciation should be calculated on original cost. If this method of calculation were followed, Justice Brandeis said, the rate of return from the fares now in effect would be 7.78 per cent instead of the 6.26 per cent shown by the company's computations.

New Jersey Rates Down $2,000,000 in 1929

RATE reductions of more than $2,000,000 in 1929 and an estimated total reduction of $31,056,000 since 1924, the greater part being in charges for electricity, are set forth in the twentieth annual report of the New Jersey Board of Public Utility Commissioners, just submitted to the Governor.

Five power companies furnish the state with more than 95 per cent of its energy. The commission asserts that reductions in electricity costs to consumers have been accomplished in a large measure by the elimination of comparatively small and inefficient power stations and the transmission of power to substations. An increase is shown in the number of consumers, induced by the development of improved devices coupled with a lower rate.

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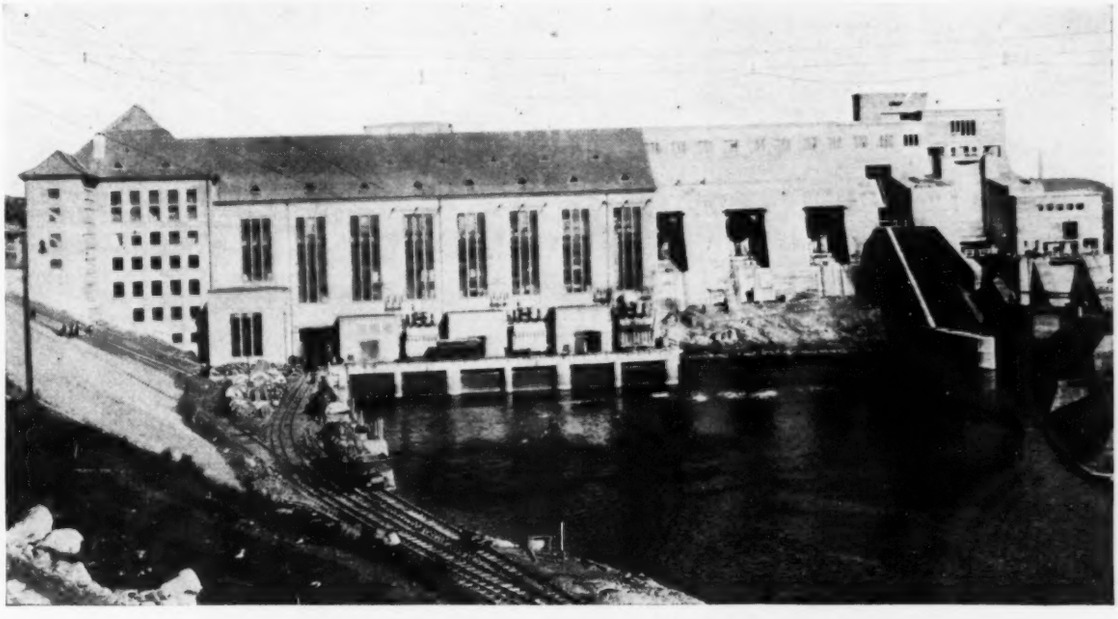
Detroit Edison Company Looks a Year Ahead

NOTWITHSTANDING the fact that 1929 was a year of major additions to the generating capacity of the Detroit Edison Company — three 50,000-kw. units having been added to the system — another addition of the same size will be made in 1930. This



SHANNON POWER HOUSE AWAITS OPENING

Ireland's famous hydro-electric development on the River Shannon, near Limerick, built by the Siemens-Schuckert company of Germany, will soon be delivering energy. The photograph was taken from the lower water side, looking out.

will be at the Marysville station. At Connors Creek about $3,000,000 will be spent on an outdoor switch house which will take over the duty of the switching equipment now installed in the plant. Half a million dollars will be expanded at Delray No. 3, and further improvements are contemplated at Trenton Channel. Total cost of all work to be undertaken at the power plants will be more than $6,000,000.

Underground and overhead transmission lines, including a fourth 120-kv. circuit from Marysville to Detroit and a second 120-kv. line in the southern part of the company's territory, will take $5,000,000. Two large cathedral-type substations are now under way. Other plans bring the company's total construction budget for this year to $27,000,000.

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New Hampshire Power to Be Available in Massachusetts

AN ORDER was issued last week by the Public Service Commission of New Hampshire permitting the export of electric power to Massachusetts under stipulated safeguards to the effect that the transmission company would agree to be amenable to the rules and regulations laid down by the New Hampshire commission and that exportation of power should be only if there were no market at fair rates for electrical energy in New Hampshire.

A permit was issued to the Grafton Power Company, and this company will be allowed to construct a transmission line from its plants at Fifteen-Mile Falls, N. H., to the Massachusetts line, a distance of about 126 miles.

Detroit Edison Company Builds Tall Substation

UNUSUALLY high is the new Chandler substation of the Detroit Edison Company, a combined switching and distribution station. Its first two floors house 4,800-volt switches and line regulators. The third, fourth, fifth and sixth floors accommodate the main switchboard, 24,000-volt buses and 24,000-volt switches.

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Rates Down in Washington, Dallas and Seattle District

FORESHADOWED reductions in the rates of the Potomac Electric Power Company of Washington went into effect at New Year's. The household lighting rate will be 4.7 cents per kilowatt-hour, a reduction in this rate of a half cent under the 1929 rate of 5.2 cents. Other reductions bring the total saving to customers to $660,000 as compared with the year 1929.

Approval has been given by the Dallas authorities to an alternate schedule of domestic power and light rates proposed by the Dallas Power & Light Company, which is expected to save the householders of the city about $200,000 a year.

Ranging from 0.5 cent to 1 cent a kilowatt-hour in the primary rate, a reduction in all lighting rates, both residence and commercial, has been announced by A. W. Leonard, president of the Puget Sound Power & Light Company, Seattle, the reduction applying to all territory served by the company except Seattle. It is estimated the cut will result in a saving of $200,000 annually to consumers. Reduction in the cost of electrical energy to patrons of the Seattle light department outside the city limits by 1 cent, bringing the charge from 7 cents for the first 35 kw.-hr. to 6 cents, has been announced by J. D. Ross, superintendent of lighting.

Park, Power or Both at Great Falls of Potomac?

PROBABILITY of power development on the Potomac River at Great Falls will disappear, it is believed, if Congress passes a bill of Representative Cramton which would authorize the acquisition by the government for park purposes of land on the shores of the Potomac and adjacent thereto. The bill has been reported favorably by the committee on public buildings and grounds and is intended to provide for the development of a continuous park system in those portions of Maryland and Virginia contiguous to the District of Columbia.

Such opposition as is heard to the measure is not hostile to the development of the park in the gorge of the Potomac River. It is based on the assumption that no power development will be authorized in an area set apart for park purposes. It is contended that a more logical course to pursue would be to await the results of the survey now being made by the Corps of Engineers. It has not yet been proved that navigation and power development cannot go hand in hand in the development of the river and of the capital's park system.

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Couzens Will Not Push Power Clause of Bill Now

ON THE resumption of hearings on the federal communications bill by the Senate interstate commerce committee, Senator Couzens, author of the bill and chairman of the committee, indicated positively that the intent is to isolate, and perhaps eliminate, the features of the bill dealing with electric power operations. The Senator stated informally that the plan is to confine the present hearings, which may last a month, to the communication features and that attention, if any, to the power features probably will be delayed until after the bill, as solely a communications measure, is dealt with in the Senate.

This does not mean that the Senator's proposal that electric power transmission across state lines by companies doing an interstate business be brought within federal regulation has been abandoned. He says that it may be dealt with at some time in the future separately from the proposal to create a federal commission to regulate radio, telephone, telegraph and perhaps cable operations.

It may be done, he said, in connection with proposals to reorganize the Federal Power Commission. These are of two kinds—(1) that the commission be composed of three specially appointed members and be left substantially with its

present powers only, and (2) that it be so reconstituted, with—in addition to its present powers—authority to exercise regulatory functions after the manner proposed in the Communications Commission bill.

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Ford Loses Troy Dam Suit for Fourth and Last Time

A DECISION handed down by the United States Supreme Court on Monday holds that the Little Falls Fibre Company and Harry A. Furman were entitled to an injunction and to damages against Henry Ford & Son because that firm placed flashboards on the federal dam at Troy, N. Y., raising the level of the water above the dam about two feet. The complainants contended that the new level resulted in raising the water at the tailraces of their plants and reduced the power developed at their dam, about three miles above the federal dam.

The Fords contended for immunity against injunction and damages on the ground that the Hudson and Mohawk Rivers are navigable and that the acts complained of were done under the authority of the government. The Supreme Court, however, held that the federal water-power act does not authorize the granting of licenses which would enable the licensee to destroy the rights of riparian owners and that the respondents were entitled to protection against appropriation of their water power.

As recorded in the "Recent Court Decisions" of the ELECTRICAL WORLD on October 20, 1928, and January 26, 1929, this case had been fought from the New York Supreme Court through the Appellate Division and the New York Court of Appeals to the United States Supreme Court.

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Senator Norris Urges Hydro Development for Nebraska

SENATOR NORRIS journeyed to Nebraska during the holiday recess, partly to seek to induce the Twin Valleys Association, fostered by business men and farmers of southwestern Nebraska, to accept his advice and include power development in the plan they are urging on Congress to provide for irrigation in connection with proposed flood-control construction in that section. Officers of the association expressed disappointment over his attitude. They feel convinced that if they include public ownership and operation of power plants in connection with the project, it will fail to meet congressional approval, and they prefer irrigation so greatly that they have decided not to ask for power development.

In a public address the Senator declared that it would be "a public sin and unpatriotic act" to build large dams and construct huge reservoirs without utilizing them for power purposes.

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Plan for Cumberland Falls Park Revived in Kentucky

CONTROVERSY over the Insull project to build a hydro-electric plant at Cumberland Falls, Ky., still rages in that state. The Cumberland Falls Protective Association, an organization of those opposed to hydro-electric development, which has headquarters at Lexington, announced on January 2 that letters had been mailed that day stating that the offer of General T. Coleman du Pont to purchase Cumberland Falls and present it to Kentucky as a public park had been renewed. Acceptance of the property by the State Legislature will be asked again at the present session. Of course, General du Pont cannot give away what does not belong to him, but it is proposed to get around this difficulty by giving the right of eminent domain to the State Park Commission and letting the General foot the bills.

City's Overtures Repulsed by Los Angeles G. & E.

A RESOLUTION recently passed by the Board of Water and Power Commissioners of the city of Los Angeles urges the acquisition by the city of the entire electric system of the Los Angeles Gas & Electric Corporation. The resolution incorporated the provision that the purchase should be made at a fair valuation to be determined "by mutual agreement, if practicable, or by the California Railroad Commission."

The Los Angeles Gas & Electric Corporation will not consider the proposal of the municipal Bureau of Water and Power that the city should purchase its system, according to an announcement made by Addison B. Day, president of the corporation, who said:

> The city has been trying for years to get control of our system. We have refused to sell in the past and shall continue to refuse in the future. We consider that to give the water board a full monopoly of the electric business in the city would amount to a major calamity. The fact that the city's system competes with ours is the only thing that keeps the prices down to their present low level. The city has a monopoly in water service, and water rates are constantly going up. It is forced to compete in the power business and power rates are constantly being cut. At present our rates are actually 10 per cent lower than the city's, since we are forced to pay taxes and the city's system is not, but competition is needed to keep these low prices in force.

MONTREAL'S LATEST SOURCE OF POWER

Here is the new hydro-electric plant built by the Montreal Island Power Company to serve the Montreal Light, Heat & Power Consolidated. It now contains the first two of ten 12,000-hp. generating units that will eventually be installed

POWER
FROM PUMPED WATER

©Fairchild Aerial Surveys, Inc.

During off-peak periods steam-electric power may pump water into storage for peak use in hydro plants—
100 kw.-hr. of off-peak steam energy is converted into 79 kw.-hr. of on-peak hydro energy in two plants at Rocky River, Conn.

EDITORIALS

L.W.W. MORROW
Editor

Industrial Modernization This Year's Electrical Opportunity

IF ELECTRICAL men but have the vision and the courage to do the job, 1930 may be made the greatest year of market development in the history of the industry. For American business is conscious as it has never been before of its need for just those efficiencies and economies that electric service provides.

This has been made very clear in the recent conferences in Washington. President Hoover has marshaled the executives of our national industries and trades for an expression of capacity and purpose. It has been in each case a demonstration of the dependence of national leadership upon local accomplishment. For each speaker has stressed the point again—that the greatest opportunity for progress lies in the modernization of industry and a reduction of the wastes that now exist in the distribution of commodities. The first objective, it is agreed, should be the careful and thorough study of manufacturing processes throughout the country, and an appeal has gone forth to industry to make immediate improvements in factory, plant and equipment as a stimulus to employment and to business. Such a contribution to prosperity will pay for itself promptly through the increased efficiencies provided.

Boiled down, what does it mean? Every electrical man knows. In all parts of the country there is a very large amount of partial obsolescence in manufacturing establishments. It can be corrected primarily by better applications of power equipment, better methods of material handling, improved illumination, more care in production planning and more effective operation of personnel. And the first step in most cases should be a modernization in the use of motors, electric heating and of light.

Attention of late has been focused much upon the long-neglected field of domestic load development—and it was high time. The energy that is now being directed there should not be diverted elsewhere—for every day and dollar spent in building residence business pays a profit and provides a much-needed public service. But the limelight of broad public interest now plays squarely on the factory, and it places a responsibility upon the electrical man that he should be quick to welcome and assume because it carries with it such a richly compensating opportunity. The power companies should organize at once to intensify their engineering and selling service to this field without diminishing the activities in other markets. The manufacturers, distributors and installers of industrial equipment should increase their efforts in the same direction.

No man can visit fifty factories in any area without observing and acknowledging the need for such a campaign of modernization. Complete rehabilitation will require the co-operation of many agencies—the building trades, the makers of machinery. But the most important service must be rendered by the electrical man. And he should lead the movement—now.

Water Power— Facts and Politics

ONCE again Governor Roosevelt of New York has pushed the development of St. Lawrence water power into the glare of publicity. He advocates a program of state ownership, development and operation of water-power resources, and his further recommendation is the retention in fee of a state-wide system of transmission for the electricity from the St. Lawrence development. He argues that low cost of money and a right-of-way along the state canals will permit of selling energy

wholesale at a low flat rate to communities or to privately operated utilities.

As a tangible step in this program he asks the Legislature to appoint a board of trustees to study his plan and report upon it. The Legislature, it is thought, will authorize the appointment of a commission to study his plans and all other proposals for the development of the St. Lawrence. Political motives influence both the Governor and the Legislature, and it is doubtful whether the game of politics will develop into constructive action. Water-power development is a technical and economic question that involves an intimate knowledge of the electric light and power business. Facts and not opinions should control. It is high time for this point of view to prevail.

The Nature of Dielectric Loss

HYSTERESIS loss in iron is commonly attributed to internal friction associated with the rotational motion of molecules under the alternations of the external field. A necessary condition for this idea is a polarized condition of the magnetic molecule. No difficulty arises here, however, as the more or less permanent polarization of magnetic materials, even in the smallest sizes, has long been recognized.

In extending the well-known parallel between the fundamental laws of magnetic and dielectric materials, however, to a similar explanation of dielectric loss difficulties have always been encountered. This is largely due to the fact that a permanent polarization of dielectrics has never been definitely recognized. Recently, however, evidences of the permanent polarization of dielectric molecules have been found in the changes encountered in the value of the dielectric constant over a range of temperature and as related to the viscosity of the material. Dielectric constant is normally attributed to a shifting of the electrons within the atoms of the substance. If, on the other hand, the larger molecule is permanently polarized, then within a certain range of frequency the oscillation of the polarized molecule should add something to the normal dielectric constant.

This is exactly what has been found. The explanation is usually referred to as the Debye theory of polar molecules, after the French physicist who first proposed it. It is usually assumed that the so-called "electrets" in which fluid dielectrics are allowed to solidify under a constant electric field, and which afterward appear to be permanently polarized, are another manifestation of polar molecules. Not all dielectric molecules are polar, and the property is supposed to arise in an unsymmetrical arrangement of the positive and negative charges in the complex molecule.

The oscillation of polar molecules in an alternating electric field would, under certain conditions, cause the same type of loss as that of hysteresis in iron. There will naturally be a range of frequency in which this loss is greatest, and this range will be associated not only with the viscosity of the material, but especially with temperature as related to the normal kinetic activity of the molecules. So far there is good evidence that much of the dielectric loss in very high ranges of frequency may be accounted for in this way. There is some evidence that a portion of the loss at lower frequencies may also be attributed to this cause.

Definite proof of this supposition, however, is yet wanting, and the matter is still under discussion and experimental attack. It seems reasonably certain that so far as concerns the commercial range of frequency and the usual dielectric losses in high-voltage power circuits, by far the greater portion of these losses arise in the anomalous conduction usually referred to as dielectric absorption.

Use the Final Test

ADVOCATES of well-rounded electrical control and measurement installations in industrial establishments have long supported extended subdivision of service as a continuous check upon the use of electricity in departments and to insure high flexibility of operation. In the present laudable trend toward a more efficient investment of capital in the field of electrical distribution (or at least in the definition of such an objective in the

minds of far-sighted engineers) outlays for the foregoing facilities are coming under sharper scrutiny. The cost of obtaining maximum flexibility through multiplication of buses, disconnecting switches, oil breakers, metering set-ups and many feeder panels is being "called on the carpet," and not a little study is being given to simplicity-cost and reliability-cost values. There is a growing opinion that too much stress has been laid in many installations upon cutting interruptions to a microscopic minimum. It is useless to attempt to set down in limited space rigorous standards of service for general application in terms of dollar outlays for varied industries, but is it not worth while to approach the matter again from the angle of actual use?

There is a strong suspicion that in many plants bountifully equipped with facilities for maximum service flexibility the management makes but perfunctory use of the subdivisions of control, switching and metering which may be available. Certain omissions might have been made without impairing the conduct of affairs. As one consulting engineer put it: "When business is quiet nobody cares about the energy consumption per unit of product, as it is then bound to be relatively high. When the factory is rushed everybody is too busy getting out the volume to give a thought to the amount of electricity consumed. In such a plant as that at 'B' kilowatt-hour records per department and per subdivision thereof are piled up on the 'logs' month after month and perhaps omitted altogether after a while. So what is the use of providing so many panels and meters, to say nothing of permanent jumper switches and so forth?"

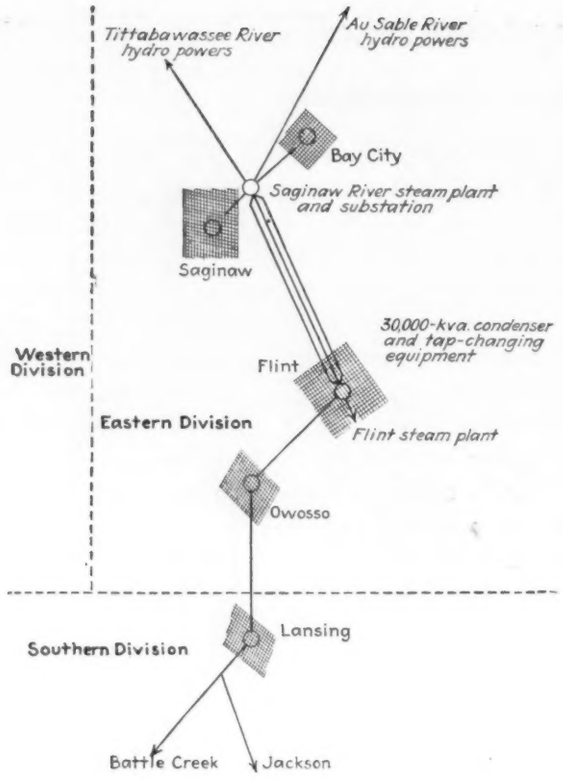
There is food for thought in these points, but, as in about all engineering problems, one brings up sooner or later at the compromise terminal. After all, use is the final justification of every phase of plant investment in its broadest sense. More complete definition of objectives in projects which the electrical engineer can treat with the superb technique now at his command will help the economic situation. There is no single answer to the question of refinements versus costs. If more searching study is permitted and rendered along these lines in the future, much good will be achieved by the exercise of sound engineering judgment free to recommend a skeleton installation from the standpoint of flexibility in one case and a plentifully appointed one in another.

Regulation Relies Upon Competition

A MONOPOLY in local distribution of electricity under commission regulation has long been held to be in the best interest of the public. But in the growth of large regional power areas the wholesale type of utility has developed. In the formative stage of an economical unified power supply for a territory, question arises as to whether a monopoly should be granted to a wholesale utility in any region. Would it be more in the public interest to have competition between utilities in order to force a more rapid development of a unified regional power system?

Last week representatives of the Insull interests in New England protested against the competitive entry of the Grafton Power Company into the wholesale power field in New Hampshire through the construction of a 220-kv. transmission line from Fifteen-Mile Falls to the Massachusetts border. This line will deliver energy to the New England Power Association system in Massachusetts and to other interconnected utilities. The New Hampshire Public Service Commission decided that energy could be exported as planned, subject to its jurisdiction and governed by the capacity of the state market to use the energy developed by the New England Power Association within the state. The commission further asserts that it is not ready to exercise its authority to extend territorial monopoly to wholesaling utilities and that the privileges of monopoly will be granted when sound economic reasons dictate that such a procedure is for the public good.

It is to the interest of all that power resources in a region should be co-ordinated and unified to bring a utility system or systems which will operate with the best current efficiencies and give the lowest prices justified on the basis of regional development. But there is a time element involved. Present investors in local utilities put their money into the enterprises in good faith and each utility performs a needed function. There should be no destructive competition, and time should be given for working out the co-operation necessary to the realization of the regional plan. Competition between wholesalers can well be used as a spur to this end, but it should not develop into a wet blanket.



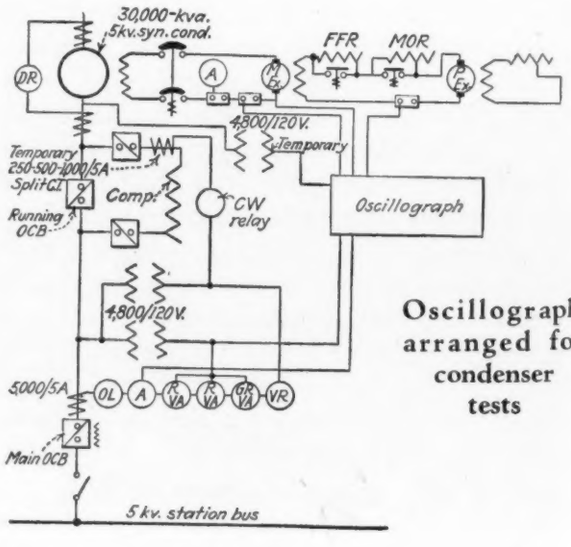
Condenser Pays Dividends

By B. E. MORROW

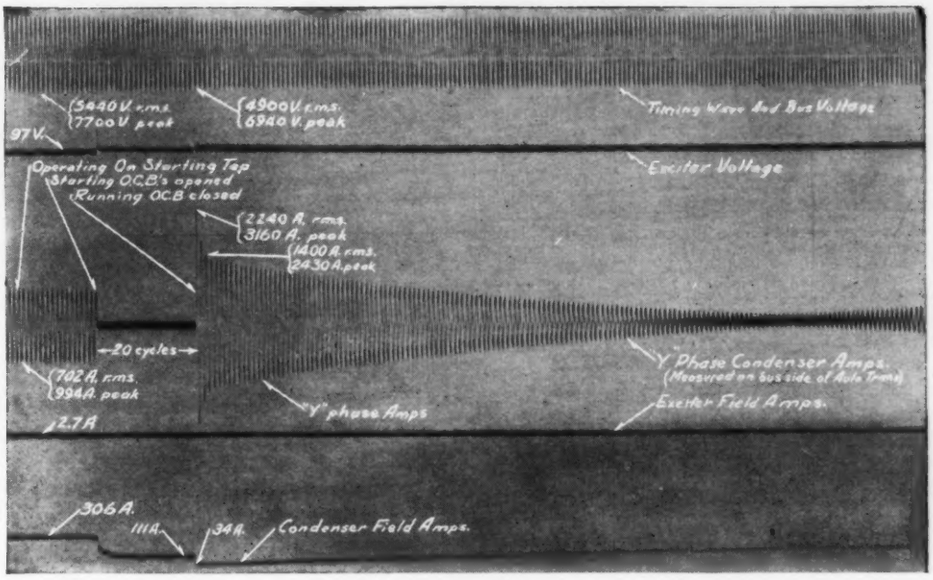
Chief Engineer Consumers Power Company, Jackson, Mich.

TO MAKE line and equipment kilowatt ratings approach their kilovolt-ampere ratings is frequently profitable. It has been found to be so on the system of the Consumers Power Company, where the investment of approximately a quarter of a million dollars for synchronous condenser and ratio control equipment resulted in an increase of system capacity equivalent to generation and transmission investment of more than a half million. There must be added to this saving an increase of operating efficiency that in investment terms brought the total saving up to nearly a million dollars. Specifically, the installation saves $74,750 annually in better steam generating efficiency and other operating improvements. It eliminates an otherwise necessary system capacity investment that would cost $68,500 per year. The gross annual saving is thus $143,250, from which is deducted the annual cost of the new installation, $33,500, leaving a net saving of $110,000. This, capitalized at the fixed charge rate of 12½ per cent, represents nearly a million dollars.

The accompanying simplified diagram shows the 140-kv. backbone of the eastern division of the Consumers Power Company system. In 1927 it became apparent that the existing and future loads in this division would shortly make it extremely difficult to maintain satisfactory voltage conditions with the then installed equipment. Transmission line, substation and generating capacities were already severely taxed to carry the large amount of wattless current circulated through the system by the comparatively low power factor loads of industrial areas centering at Flint, Owosso, Saginaw and Bay City. The power factor of the load in the eastern division in 1927 was about 70 per cent. The eastern division load was being carried principally by the steam plants at Saginaw and Flint, with major contributions from the hydro powers on the Au Sable and Tittabawassee Rivers, as indicated in the diagram. At times, also, it was necessary to import power from the southern division. The large requirement of the reactive kilovolt-amperes necessitated the operation of more generators than actual power demands would require. Running generators at points far below their best efficiencies is a distinctly



Oscillograph arranged for condenser tests

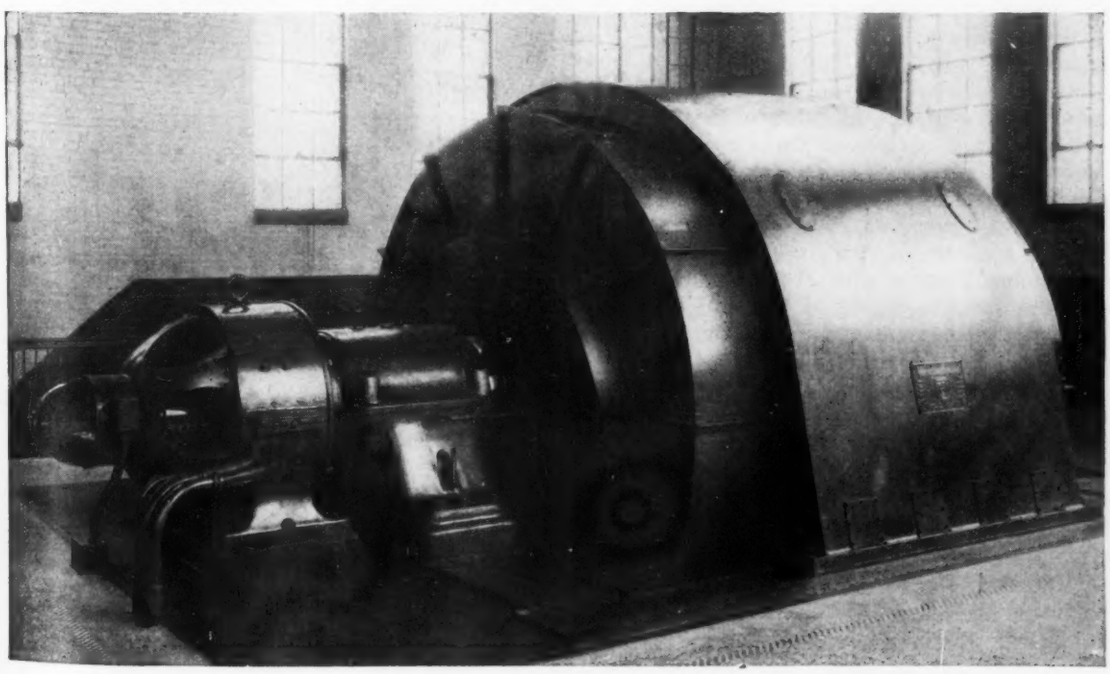


Starting condition during transfer to running breaker

uneconomical operating condition. Also the heavy wattless currents circulating about the system caused excessive voltage drops and losses in transmission lines and transformers. It was time for something to be done.

A study of the situation was made by engineers of Stevens & Wood, Inc., and of the operating department of the Consumers Power Company. The decision was that correction lay in the installation of condensing and load ratio control equipment. It was concluded that a 30,000-kva. synchronous condenser should be placed in the center of the system at Flint, where also the largest industrial load is concentrated. The load ratio control equipment was to be put on the existing 22,000-volt transformers at this location. In this article we are interested only in the synchronous condenser and no space will be given to the load ratio control, although it plays an important part in the improved operating conditions, particularly in Flint and the adjacent area. The study preliminary to the decision was most exhaustive. It included consideration in detail of normal and abnormal conditions, with all possible combinations of transmission line, steam and hydro generation, substation and corrective condenser capacities. The result was that the 30,000-kva. condenser at the specified location appeared to be the satisfactory answer to all questions concerned with local service at Flint and would also simplify and improve general operating conditions throughout the system.

Improvements in normal system operation included the relegation of the Flint steam plant to stand-by status, a better operating schedule for the more efficient steam units in the new Saginaw steam plant and more econom



This condenser cost one-quarter of the saving it made

ical usage of water in the various hydro plants. These effects combined to produce an appreciably lower overall generating cost for the division.

Stated in money terms, the study showed the following results based on average operation projected for the period from September, 1928, to September, 1930:

Analysis of Value of Condenser to System

Operating and fixed charges:		
Cost of condenser installation	$266,000	
Annual charges at 12½ per cent		$33,250
Gross savings in steam efficiency and other operating improvements		74,750
Net operating saving		$41,500
System investment eliminated on account of increase of capacity in lines and other equipment:		
Generating equipment	$392,000	
Lines and substations	156,000	
Total added capacity value	$548,000	
Annual charges saved at 12½ per cent		$68,500
Total net savings per year		$110,000

This article was written in October, 1929. During the year of operation elapsed since the installation of the condenser the actual results attained have been at no appreciable variance from those indicated by the study.

Now, as for the machine itself. It is of Westinghouse manufacture and is rated at 30,000 kva., 5,000 volts, 3.460 volts per leg, 60 cycles, three phase, 720 r.p.m., field amperes 400, field volts 250. The exciter equipment consists of a 130-kw., 520-amp., 250-volt main unit and a 5-kw., 250-volt pilot, both mounted on the condenser shaft. The condenser has no field rheostat, field control being vested in the main exciter output voltage. This exciter is of the quick-response type with pairs of field coils in series-parallel connection in order to reduce the inductive reactance to changes in field current, thus cutting down the time required to build up the exciter field. The regulator which is a part of this system is supplemented by a field-forcing rheostat and a motor-operated rheostat. The condenser is started at reduced voltage by means of a compensator. A feature of the starting cycle is the open circuit transition from the starting to running positions, which is apparent in the accompanying test oscillogram.

A series of tests were made in May, 1929, to check the performance of the condenser and also to determine its starting and running characteristics in relation to the system. The results of the tests showed that the most satisfactory condition in transferring from the starting to the running breaker is with heavy overexcitation on the condenser field. The initial surge on closing the starting breaker is about 85 per cent of the surge following the closing of the running breaker with overexcitation. A very severe surge follows the closing of the running breaker when the field switch is open. Although the condenser should be put on the line during a period of light load, i.e., early morning, this is not absolutely necessary if it is started overexcited.

With particular reference to the quick-response excitation feature, the tests disclosed that on account of certain not easily changed circuit constants the speed of exciter voltage build-up is not so fast as the rate of its decay, but this does not appear to be of major consequence in operation. The operation of the exciter rheostatic voltage regulator was in general very good and was even more improved by adjustments made during the tests. The regulator performs a valuable function in maintaining the station bus voltage and capitalizes the condenser capacity to the maximum extent. It is felt that the condenser would not be a complete operating unit without it.

As a concluding remark, it can be said that the condenser has materially improved service in the Flint district and has relieved load conditions throughout the eastern division as well as on the lines and transformers in its immediate area. It operates at practically full load during system load periods and is often used for voltage regulation during light load times. It has proved to be a distinct operating asset, has simplified system operation and improved service.

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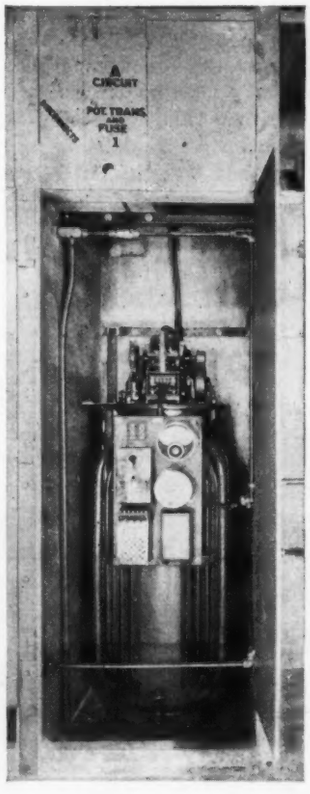
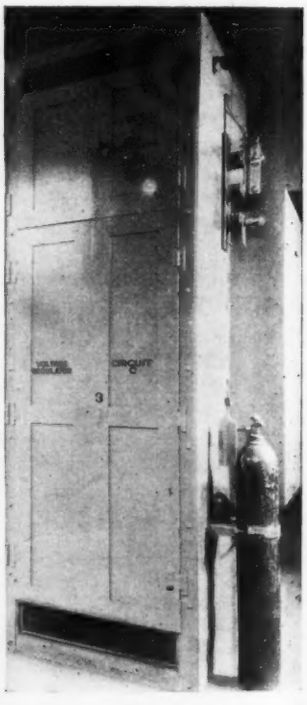
Fire Protection on Regulators

By F. M. MARTIN

Columbia Engineering & Management Corporation, Cincinnati, Ohio





Unit type carbon dioxide protection

SUBSTATION design on the system of the Union Gas & Electric Company, Cincinnati, Ohio, includes the housing of induction feeder voltage regulators in fire protective structures and the use of carbon dioxide for fire suppression. The accompanying illustrations show regulator installations in the Evanston and Norwood automatic substations on 4,325-volt distribution feeders. The Lux system of equipment is used. The regulator inclosures are concrete cells with transite

doors. The potential transformers and disconnecting switches are located in the same cells above each regulator. Each set of three regulators on a circuit is provided with its own carbon-dioxide cylinder and operating mechanism, the mechanism being actuated by the parting of fusible links installed in each compartment. These links are designed to fuse at a temperature of 165 deg. F. The carbon dioxide piping is carried through the wall at the back of the compartment, and in addition to the nozzles at the back a branch ending in a perforated pipe is carried down and across the front of each regulator. The cost of this protection for each set of regulators is not excessive and it is believed that a high degree of protection is thus obtained.

A feature of the fire protection scheme can be seen at the top of the transite door inclosure, where a hinged steel plate is provided to close the upper opening in case of fire, the plate being held open normally by a latch which is operated by release of gas from the carbon-dioxide cylinder. This eliminates the draft action from bottom to top of the compartment, which is desirable during normal operation, but which during a fire would carry out the carbon dioxide very rapidly. Carbon-dioxide concentration may be thus maintained in the compartment with a minimum supply of gas.

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Simple Chart Aids Forecasting of Run-Off

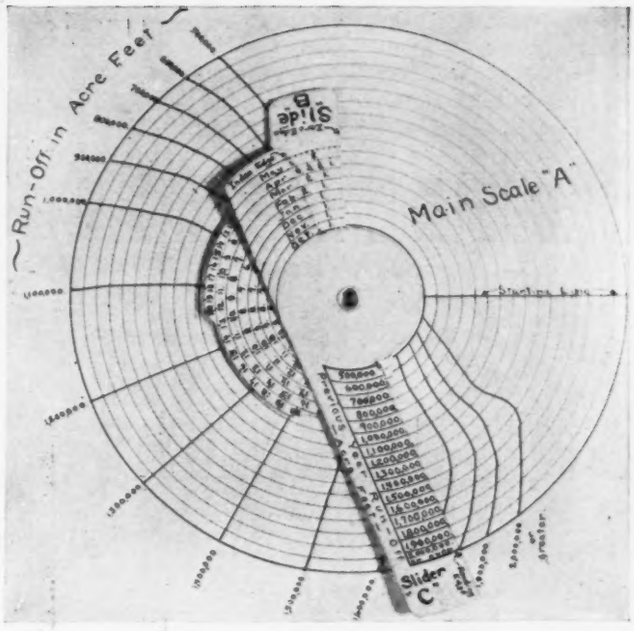
By L. H. PARKER

Assistant Superintendent Electrical Department, Turlock Irrigation District, Turlock, Calif.

THE problem of forecasting the seasonal river flow for the hydro plants of the Turlock (Calif.) Irrigation District has resulted in the development of the run-off indicator illustrated herewith. The watershed of the Tuolumne River is located partially in the high altitudes of the Sierra Nevada Mountains and is inaccessible during the periods of winter snows. No accurate reports of snow depth and water content are available until very late in the spring, consequently power and storage schedules in the past could not be satisfactorily formulated as early in the year as was desirable.

Working under the suggestion of R. W. Shoemaker, consulting electrical engineer, that run-off could probably be forecast early in the season through the use of rainfall records from some low-level, easily accessible station, modified by the two factors of wetness of previous years (as controlling vegetation growth and ground saturation) and of seasonable distribution of rainfall (as controlling effectiveness of precipitation for direct run-off), some very interesting and useful results were obtained.

By group plotting of records of years of similar conditions variables were successively eliminated and constants determined which showed the rather unexpected fact that rainfall occurring early in the fall indicated a greater effect on run-off than an equal amount of rainfall occurring later in the spring immediately prior to the peak run-off. Also, the wetness of the previous year had an effect on the current year's run-off that did not vary directly as a function of the previous year's wetness, but rather as a partial function of the wetness of the current year.



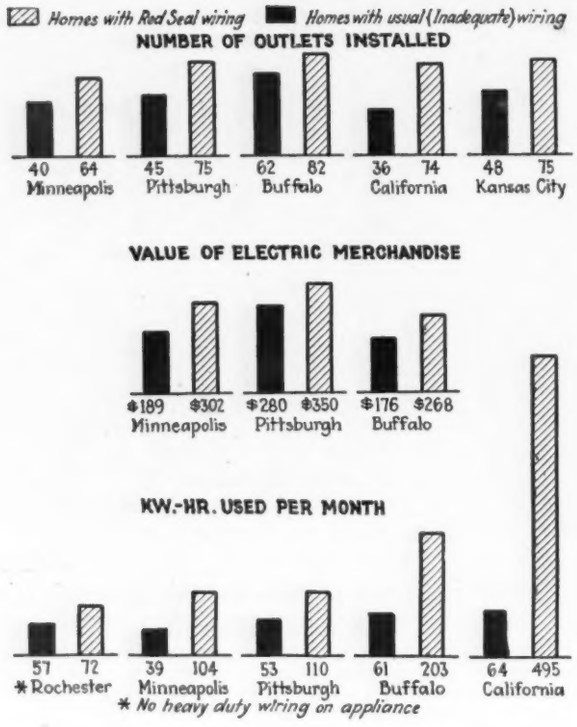
Run-off indicator permits graphic determination of seasonal river flow

Procedure: Set reading edge of slider *C* at starting line of main scale *A*. Clamp slider *C* (by clamp is meant pressing against main scale *A* so as to prevent rotation thereof). Set zero edge of slide *B* even with index edge of slider *C*. Clamp slide *B*. Rotate slider *C* counter-clockwise until index edge for October comes opposite slide *B* number corresponding to inches of rainfall measured at the Sonora U.S.G.S. station for the preceding October. Clamp slider *C*. Rotate slide *B* until zero edge comes even with index edge of slide *C*. Clamp slide *B*. Rotate slider *C* counter-clockwise until index edge for November comes opposite slide *B* number corresponding to inches of rainfall measured at the Sonora U.S.G.S. station for the preceding November. Clamp slider *C*. Repeat above two operations for successive months up to and including May. Opposite figure on slider *C* previous year run-off corresponding to measured natural run-off of Tuolumne River for previous year (ending previous September), read estimated run-off for year as indicated by contour lines on main scale *A*.

Mention should be made that while the Sonora station, which was used as a basis for these determinations, is not on the same watershed as the Tuolumne River, yet the records of the Sonora station (which may be in the same "weather current" as the Tuolumne River watershed) showed a closer relationship than any of the available records of stations that were actually within the watershed.

The particular circular chart form of the indicator was used as it allowed an almost unlimited adjustment of variables and at the same time furnished the simplest graphic determinations. By its use it is possible to estimate the run-off of the river with an accuracy sufficient for power scheduling and with a reliability equivalent to 34 out of the 36 years of which there are records available.

Adequate Wiring Gains

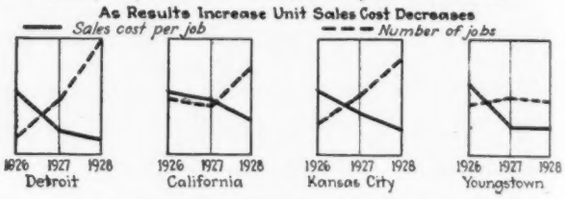


Results of organized adequate wiring effort in new homes

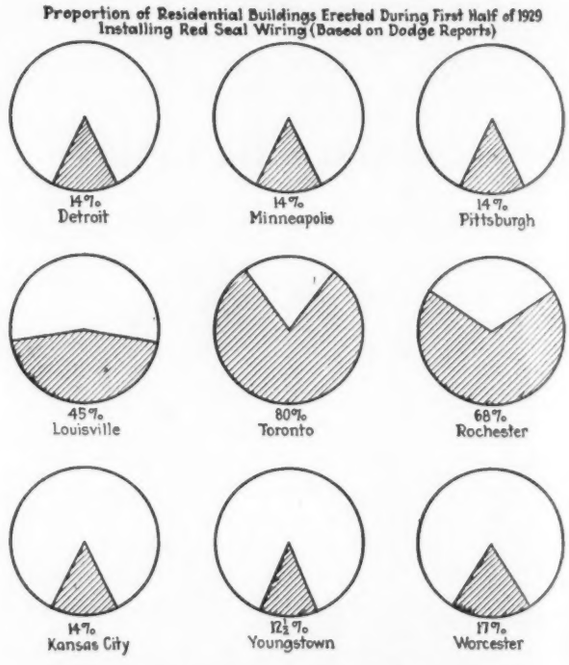
Cost of entire campaign loaded on only those jobs actually certified

	Per Job	Per Outlet
Pittsburgh	$29.60	*$6.56 ($3.54)
California	$26.88	*$3.74
Kansas City	$16.00	$3.74
Denver	$15.20	$6.04 ($4.04)
Chattanooga	$15.70	$2.44
Detroit	$9.92	
Toronto	$7.50	

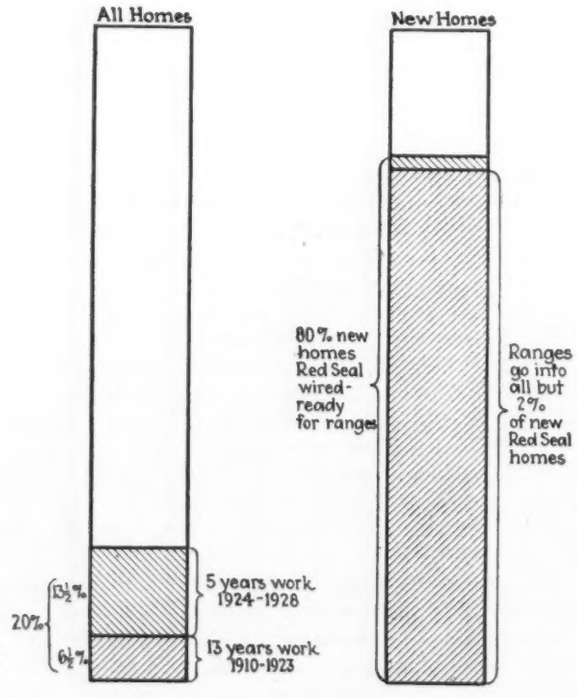
* *Heavy duty service and other special requirements credited*


As Results Increase Unit Sales Cost Decreases
Sales cost per job
Number of jobs
1926 1927 1928 Detroit
1926 1927 1928 California
1926 1927 1928 Kansas City
1926 1927 1928 Youngstown

Cost of selling adequate wiring by the red seal plan



Getting new homes adequately wired



Effect of "red seal" on electric range saturation

A RECORD of Red Seal home wiring comparing results in a number of American cities was offered by Kenneth A. McIntyre, managing director Society for Electrical Development, at the recent meeting of the Association of Edison Illuminating Companies. In connection with a survey of 40 cities, according a single method of analysis, Mr. McIntyre mentioned the Electrical Industry Sales Conference to have found that: The American home offers a large undeveloped market for wiring, electrical appliances and increased use of electrical energy.

Operation of Neon Tubes

Laboratory tests on cold-cathode tubes under various conditions of energy supply furnish data significant to operation and indicate possibilities of new uses

By J. K. McNEELY and R. P. BALLOU

Electrical Engineer and Research Assistant, Respectively, Engineering Experiment Station, Iowa State College

THE rapidly growing application of neon tubing as an illuminant for electric signs and other displays makes desirable an extension of understanding of tube characteristics to the operators and installers of these devices. It is accepted that designers and manufacturers already have this information, but to those concerned with the day-to-day performance of neon signs it is assumed that the field of tube characteristics is somewhat of a *terra incognita*. In order to present this information from a disinterested source the Engineering Experiment Station of Iowa State College undertook and has recently completed a study of cold-cathode tubes (the type most commonly used) operated on alternate-current, direct-current and high-frequency power. The results of the tests indicate certain requirements of design in relation to tube lengths and supply transformers, show phenomena of high-frequency operation that may hold promise of a means for high-frequency control of exceptional sensitivity and supply quantitative data on tube characteristics, including operating and visual efficiencies.

The cold-cathode type of neon tube requires a much higher voltage to start its operation than to maintain it. The voltage required to start an appreciable current through the tube and illuminate it is called the breakdown voltage. This voltage varies with the total length of tube (as shown in Fig. 1), the number of lengths in series and their lengths. The breakdown voltage for

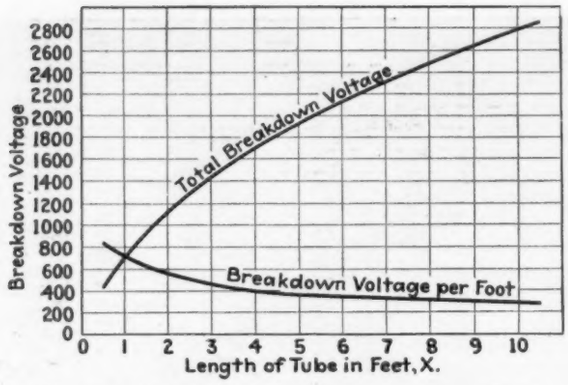


Fig. 1—Breakdown voltage vs. length of single tube (60 cycles)

two or more tubes in series is not the sum of the breakdown voltages of the lengths separately, but is less. It is greater, however, than for a single tube of equal length.

In practice, a number of tubes are used in series, so the breakdown voltage for the combination will be less than the individual breakdown voltages. A compilation of data for a number of combinations of tubes is given in the accompanying table. While no definite laws between the several variables can be deduced from these observations, certain generalizations can be made, as follows:

The savings are greatest when (1) the tubes are long, (2) the number of tubes is great, (3) the difference in lengths of tubes is a minimum.

Note again that the greatest saving does not mean the minimum voltage. The minimum voltage occurs with a single tube. The savings are over the summation, and the summation increases rapidly as the tubes are shortened and the number of them increased.

The following arrangement of data from the table is illustrative of this point:

Length		Breakdown Voltage
Single section 10 ft. long		2,780
$1\frac{1}{2} + 3\frac{1}{2} + 5$ ft.	Actual	3,620
	Summation	4,520

In this case the actual voltage is almost an exact average of the single section and summation voltages. Were this always the case, the problem of finding the breakdown voltage for a group of tubes in series would be very simple, but the relation does not hold.

However, the single section and summation voltages

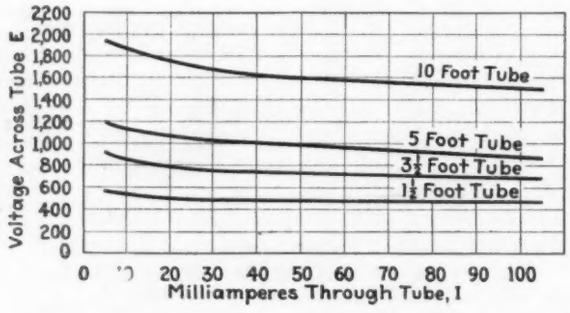


Fig. 2—Sustaining voltage vs. current (60 cycles)

are, respectively, the minimum and maximum limiting values between which the actual value will be found. If these values do not differ too much, the error of assuming the average voltage to be actual voltage will be small, and this constitutes a simple way of determining the approximate breakdown voltage for several tubes in series. Values may be compared for any similar arrangements found in the accompanying table.

The variation of voltage with current for four different lengths of neon tubing is indicated in Fig. 2. It will be seen that the voltage is nearly constant, and such change as there is (except for the very low values of current) is practically a linear decreasing function of the current. As neon tubing is usually operated at 20 milliamperes for ordinary signs, and up to 50 or

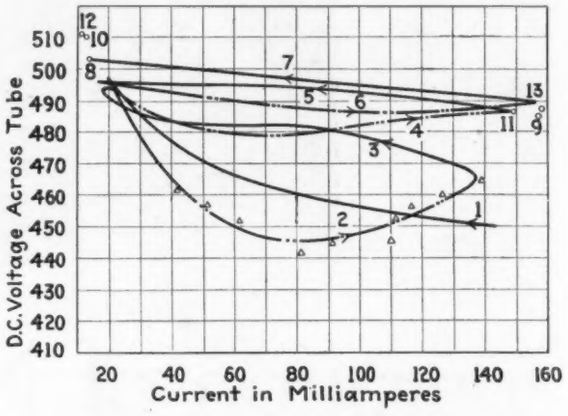


Fig. 3—Voltage vs. current in successive applications of direct current

The tubing was first run 30 minutes at about 50 milliamperes to minimize subsequent temperature variations. Then the tube current was raised to 119 milliamperes and alternately reduced and raised seven times through a range of 20 to about 150 milliamperes. Each step is numbered in rotation. Cycles 1, 2 and 3 were repeated thirteen times, but to avoid complication the points are not plotted; those for curve 2 were the only ones which scattered. Immediately after cycle 7 the voltage was quickly raised, establishing point 9, decreased (10), increased, etc., ending with point 13. The lines between these points are omitted as they virtually coincide.

more for signaling, the voltage below 10 milliamperes is never important.

The tube voltage decreases with increasing current. For stable operation the transformer voltage must drop more rapidly than the tube voltage for any current increase. External influences, although greatly affecting the breakdown voltage, have but little effect on the sustained operation of the tubing. Grounding the metal frame or sign on which the tubes are mounted, even when the center tap of the high voltage is grounded, produces no change. After long usage the electrical properties as well as the optical are somewhat altered. Likewise, weather conditions may produce a slight change in the color of the light if the tubing is improperly made or the gas contains impurities.

The breakdown voltage with direct current is not as definite as with alternating current. On repeated tests it varied over wide limits, although in general it was between 1,600 and 1,900 volts on a $1\frac{1}{2}$-ft. tube. Once slightly over 2,000 volts was applied without starting the tube, and it occasionally started with apparently less

than 1,600. A very small transient, such as produced by closing and opening the voltmeter switch, was sufficient to start it. In operation, the sustaining voltage was about the same as that with alternating current. With direct current the effect of external influences was very marked, as shown by the curves of Fig. 3.

From this curve it would appear that the element of time is a factor in predicting the voltage drop across the tube with direct current, although its power in the equation has not been determined. A spiral of wire wrapped around the entire length of the tube and grounded had absolutely no effect. The peculiar voltage and current effects in direct-current operation are probably due to some sort of temperature and pressure conditions within the tube itself, for changing the polarity of the tube caused greater difficulty in starting the tube; even after it has been started once or twice,

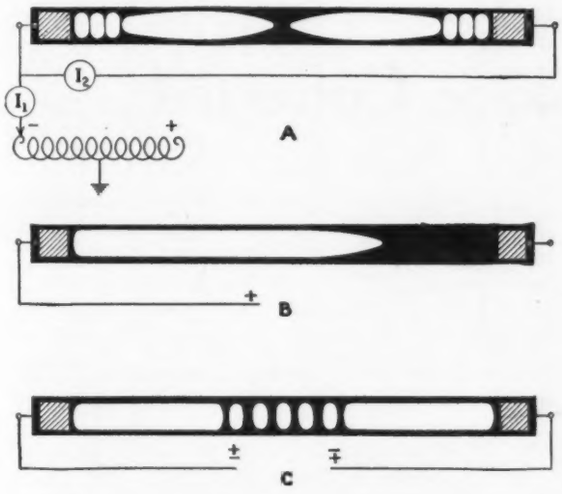


Fig. 4—Luminescent sections produced by high frequency

A—The terminals were connected by 3 ft. of No. 14 lamp cord, the frequency was 1,365 kc. The two pencils of light could not be made to meet. Bringing a grounded electrode near the tube shifted the dark space away from the electrode. It also intensified the striæ at each end and in certain positions would cause longitudinal motion of the "bubbles of light.' The heating of the terminals was about the same. $I_1 = 102$ milliamperes; $I_2 = 89$ milliamperes.

B—Operated from positive end of oscillator inductance, the tube being well insulated and one end unconnected. The illuminated pencil could be controlled by a condenser across the oscillator inductance. With a frequency of 3,740 kc. a glow was just visible at the positive end. Changing the frequency either way increased the light pencil. At 2,690 and 4,535 kc. the glow filled two-thirds of the tube. With a different inductance a glow was just visible at 4,220 kc. and completely filled the tube at 2,992 kc. The lowest frequency at which the tube was operated was 1,306 kc., when the glow was uniform throughout.

C—Both ends connected to oscillator inductance. At 3,585 kc. the glow was uniform throughout the tube, but at 3,055 kc. the striæ formation shown occurred, consisting of four or five bright bubbles of light (about 1 cm. each) separated by dark spaces.

it still requires a higher potential to start at the new polarity than after it had been operating that way for some time.

There were two dark spaces near the cathode which were especially visible with high current through the tube. The first extended about 2 cm. from the end of the electrode and the second occurred ½ cm. farther and extended 1 cm. Within 2 or 3 cm. of the anode the

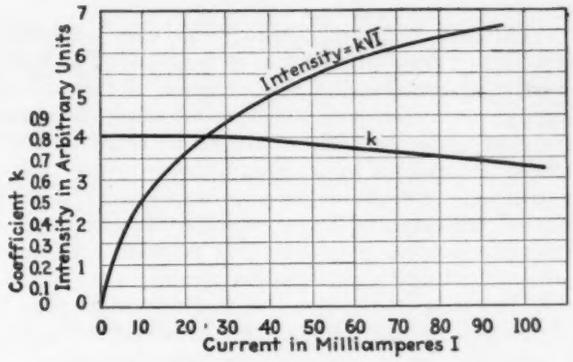


Fig. 5—Light intensity vs. current on 60-cycle operation

light was dimmer, somewhat resembling a dark space, and sometimes flickered a little. Most of the heating occurred at the cathode, although there was a small amount at the anode. The rest of the tube hardly exceeded room temperature, even when operated at a high current for a long time. This indicates a high cathode drop in potential and a large dissipation of energy at the cathode.

In order to determine whether an oscillatory discharge through neon would produce some color other than the red-orange characteristic of direct current and low frequency alternating current the 1½-ft. tube was connected across the inductance coil of a conductively coupled high-frequency Hartley oscillator using one UX-210 tube with 800 volts "B" eliminator parallel feed plate supply. The negative of the high voltage, and consequently the center tap of the inductance coil, was grounded. The light was not so bright near the negative end of the tube, while the positive end ran slightly warmer. A very slight trace of violet was visible near the walls of the tube toward the negative end. When the tube was inserted through the center of the inductance (the leads still connected and tube well insulated) the violet was a little more pronounced.

With exactly the right capacity the bubbles shown in Fig. 4 were stationary. With a slight change in capacity, they had a continual motion across the tube, toward the negative end as the capacity and wave length were decreased and toward the positive if the capacity and wave length were increased. The adjustment was very critical, and this suggests a method of determining

Breakdown Voltages Corresponding to Tube Lengths

Length of Tubes in Series (Feet)	Actual Breakdown Voltages	Summation Voltages	Saving in Voltage
1½	930	....	...
3½	1,630	....	...
5	1,960	....	...
10	2,780	....	...
1½..3½	2,300	2,560	260
1½..5	2,420	2,890	470
1½..10	3,450	3,710	260
3½.. 5	2,950	3,590	640
3½..10	3,950	4,410	460
5..10	4,500	4,740	240
1½..3½.. 5	3,620	4,520	900
1½..3½..10	4,440	5,340	900
3½..5 ..10	4,910	6,370	1,460
1½..5 ..10	4,880	5,670	790
1½..3½..5..10	5,430	7,300	1,870

with extreme accuracy whether or not a laboratory oscillator, desired to operate at a constant frequency, is remaining constant. A slight motion of the hand 2 ft. from the oscillator was sufficient to cause or stop the motion of these bubbles, a change in capacity far too small to be detected by an accurate wave meter. These are the most important effects observed at high frequencies, although a large number of variations and combinations were produced, the position and number of the striæ being especially changeable.

The intensity of the light emitted by a discharge tube is a function of the current. Fig. 5 shows this relation, the intensity being indicated in arbitrary units. The intensity varies almost directly as the square root of the current up to about 50 milliamperes, but above that is somewhat less, as may be seen from the curve of the coefficient k where Intensity $= k\sqrt{I}$.

Since the power used is very nearly directly proportional to the current the point of greatest efficiency is, for all practical purposes, indeterminate. If depreciation and other constant losses be added to the cost of energy the current for maximum efficiency can be found. Although Fig. 5 is for alternating current, similar results were obtained with direct current. It should be noted that this curve was plotted from data obtained from tests with a selenium cell, which indicates the actual intensity of the light. If the current for the maximum efficiency on the basis of attracting attention within a very limited distance is desired a curve equal to the logarithm of the intensity curve should be used. The Weber-Fechner law cites the sensation to be roughly proportional to the logarithm of the stimulus.

▼ ▼ ▼

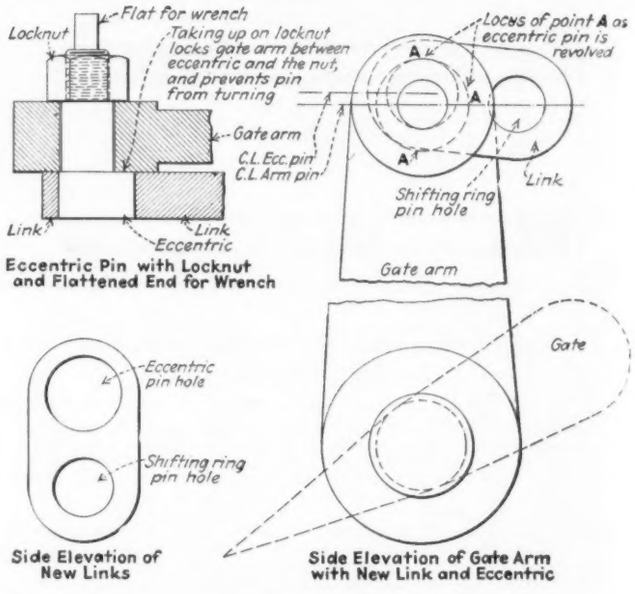
Hydro-Turbine Leakage Corrected

MOST modern water turbines of the reaction type are equipped with means by which the guide vanes around the wheel may be adjusted individually so that leakage through the machine when it is shut down is kept very low. But few older turbines, many of which are still in service, are so arranged. The leakage caused by imperfect closure of the vanes may represent an appreciable proportion of the output of a small turbine and may be an easily evaluated actual loss of kilowatt-hours.

In the Rapidan hydro station of the Northern States Power Company are two twin reaction turbines coupled to 800-kw. generators installed in 1910. These turbines are identical and they had non-adjustable links between the control rings and the vane operating arms. Indicating the losses on these machines is the accompanying table of clearances between the guide vanes on one turbine when the control rings were in the fully closed position. The vanes being 10 in. high, the total leakage area was 32.9 sq.in., which permitted the loss of more than 4 per cent of the machine capacity. The condition of the second trubine was about the same.

One machine has already been corrected in accordance with a definite plan and the other will be gone over shortly in the same way. New sets of links and pins to connect the control rings to the vane arms were made. The pins were made with two diameters set eccentrically, as shown in the accompanying illustration, and the links bored with one hole to fit the larger ends of the pins. The holes in the links for the pins on the rings were left a little small and were reamed out on the job to fit. The ends of the pins were shaped for a wrench so that they could be turned in the gate arms, the eccentric motions in the links thus providing adjustments of the relative positions of the guide vanes and control rings and permitting the elimination of clearances between vanes.

The new links and pins were made by machinists in the company plants during times that other work was not pressing and by a little attention to production details, such as the cutting of the links from a previously shaped bar of bronze, the cost of the new parts was kept very low. The cost of doing this work was saved in about six months.


Flat for wrench
Locknut
Taking up on locknut locks gate arm between eccentric and the nut, and prevents pin from turning
Gate arm
C.L. Ecc. pin
C.L. Arm pin
Link
Eccentric
Eccentric Pin with Locknut and Flattened End for Wrench
Locus of point A as eccentric pin is revolved
A
Shifting ring pin hole
Gate arm
Eccentric pin hole
Shifting ring pin hole
Side Elevation of New Links
Gate
Side Elevation of Gate Arm with New Link and Eccentric

Eccentric gate linkage for leaking reaction turbines

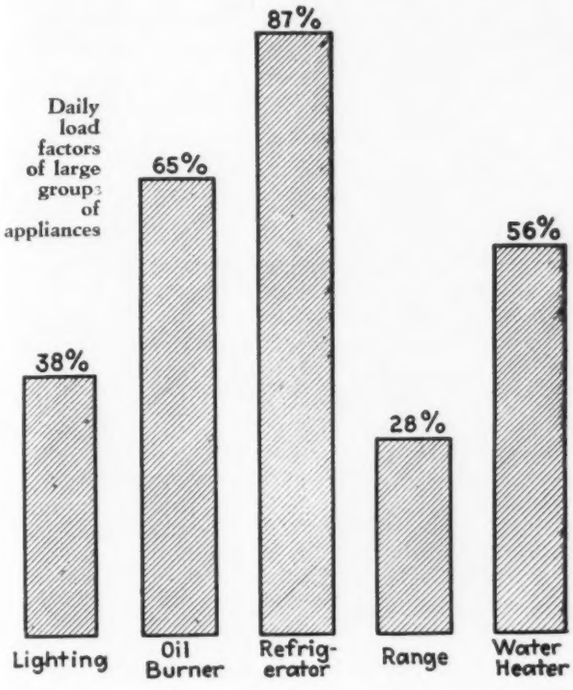
Gate Toe Clearance of Turbine No. 1

Gate	Wheel Near Generator, In.	Wheel Away from Generator, In.	Gate	Wheel Near Generator, In.	Wheel Away from Generator, In.
1	0.081	0.245	10	0.040	0.075
2	0.027	0.275	11	0.205	0.030
3	0.175	0.130	12	0.059	0.135
4	0.027	0.154	13	0.250	0.030
5	0.089	0.019	14	0.130	0.138
6	0.008	0.089	15	0.115	0.030
7	0.091	0.059	16	0.000	0.142
8	0.081	0.130			
9	0.105	0.134	Total of Wheel	1.475	1.815

Water Heating as a Load

By Harry A. Snow

Assistant Controller Detroit Edison Company



SINCE June of 1928 the Detroit Edison Company has concerned itself with a series of tests on electric water heaters in order to obtain an idea of the load-building possibilities and of the electrical characteristics of this service. The study has been limited to water heaters in average size residences. The possibilities of use in stores, barber shops, clubs, etc., were not studied in this test.

THE TESTS have been conducted under service conditions upon heaters installed in homes typical (with one exception) of the average American family in rather moderate circumstances. The refinements of laboratory tests have been avoided and no effort was made to determine the relative advantages of different makes of electric water heaters. Electric water heating is a very promising field for intensifying electric service in the homes and these data should help the industry greatly.—*Editors.*

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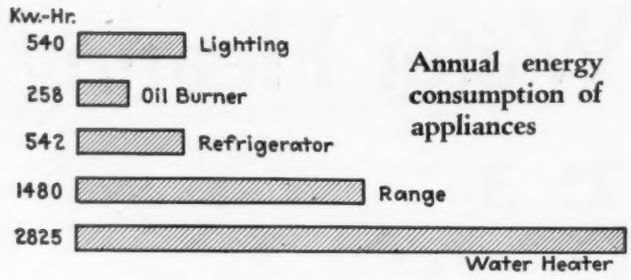
THE problem of determining good average operating data for a large group of electric water heaters is difficult because of the numerous variations in the design, installation and use of the heaters. For example, while refrigerators are always controlled automatically by thermostats, and ranges are always operated manually, water heaters may be installed for either type of control. Furthermore, some water heaters are installed in series with hot water loops in the house-heating furnaces and others are fed with cold water from the mains both winter and summer. There are also two principles of design struggling for supremacy, the high-wattage, low-storage design and the low-wattage, high-storage design. Radiation losses vary considerably between installations in which there are only short runs of well-insulated hot-water piping and installations having long runs of bare piping. All of these differences existing between individual water heater installations make difficult the determination of good average data for a typical large group of water heaters.

No attempt was made in these tests to determine operating data for water heaters operated on an "off-peak" schedule; that is, for heaters controlled by a time clock permitting them to heat water only at night, and taking their current through a separate meter. It is felt that the apparent advantages of off-peak heating should be scrutinized carefully in the light of the data on diversities, load factors and consumptions revealed by these tests before the advantages are accepted without reservation.

It is certain that off-peak heating involves the complication and the cost of time switches and extra meters and that, if a heavy demand uses up the supply of stored hot water, the customer must go without until the next day. Such disadvantages are only to be put up with if the off-peak feature is the only way in which a sufficiently low rate may be justified.

The Detroit tests show that the water-heating load, particularly for low-wattage heaters, has a very good load factor and that it very greatly increases the annual consumption per customer. If currently accepted methods of cost analysis are to be depended upon, the improved load factor and higher consumption may in themselves warrant a sufficiently low rate to attract a good



Annual energy consumption of appliances

share of this business, and it is not necessary to fool around with off-peak heating.

The tests were made on 25 standard water heaters, embracing eight different makes. All of the heaters were factory built with well-insulated tanks; no heaters of the circulation or clamp-on types were tested. The water storage capacities ranged from a minimum storage of 10 gal. to a maximum storage of 60 gal., the average storage being 24 gal. The heating elements varied in capacity from 1 kw. to 6 kw., with an average capacity of 3.6 kw.

The low-capacity heating elements were in the larger tanks, and vice versa, generally. A heater equipped with a low-capacity element recuperates slowly after its charge of hot water has been drawn upon, and therefore requires a high storage in order to supply continuous hot water service. The reverse is true for heaters having high-capacity elements, which give quick recuperation and require less storage. These facts suggest that a heater may be rated as to its ability to supply continuous hot water service by the product of its storage in gallons and its heating capacity in kilowatts. If this be true, a heater having a 60-gal. tank with a 1-kw. element would be about as useful as a heater having a 15-gal. tank and a 4-kw. element, both having products of 60. The product rating of the heaters under test ranged from a minimum of 30 to a maximum of 300. The next highest product, however, was only 150; the man who operated the 300 product heater was perhaps a little abnormal; he used electrically heated water with which to wash his automobile.

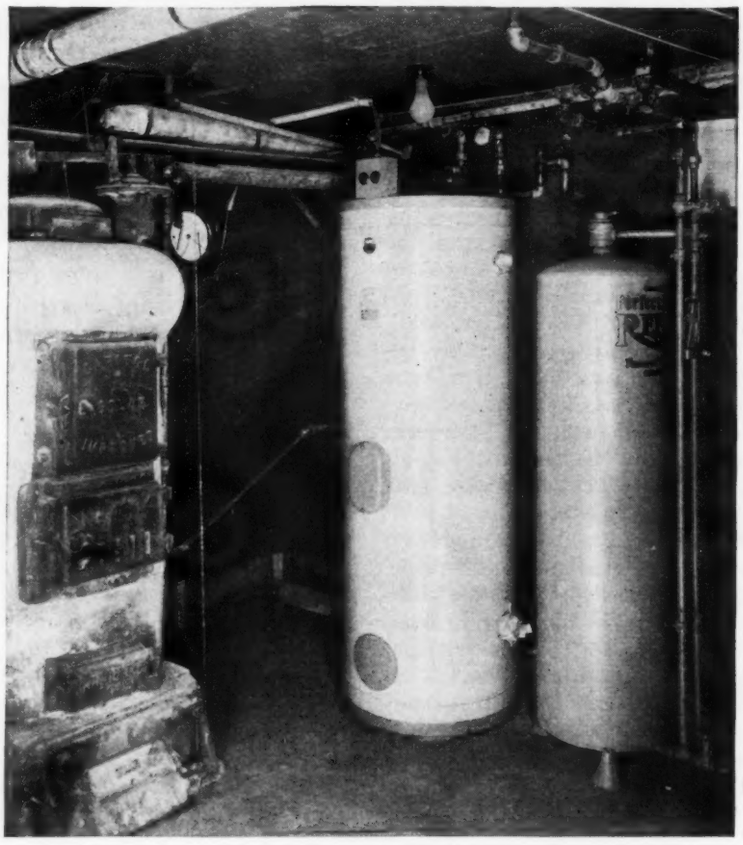
In general, a heater having a product rating of from 50 to 60 will furnish excellent full-automatic hot water service in homes of four people using about 1,200 gal. of hot water a month. Two heaters on test having product ratings as low as 30 did fairly well in bungalows housing three people each and consuming 1,180 and 1,225 gal. per month except on washdays, when the supply of hot water had to be conserved. Two other heaters having products of 81 gave good service under all conditions in homes of six people using 1,180 gal. in one case and 2,010 gal. in the other.

The product of gallons and kilowatts may be used as a gage of the usefulness of the heater in rendering hot-water service and the ratio of gallons to kilowatts may be used to classify heaters as to type; that is, as to whether they are of the high-wattage, low-storage type or of the low-wattage, high-storage type. If the ratio of gallons to kilowatts is fifteen or less the heater may be classed as a high-wattage type, while if the ratio of gallons to kilowatts is more than fifteen the heater may be considered a low-wattage type. Of the 25 heaters on test nineteen had ratios of less than fifteen ranging from three to ten, and six were low-wattage heaters with the gallons ranging from 30 to 60 times the kilowatts. Because of the large proportion of high-wattage heaters the composite load curve for all heaters is predominated by this type and therefore displays the characteristics of high-wattage service.

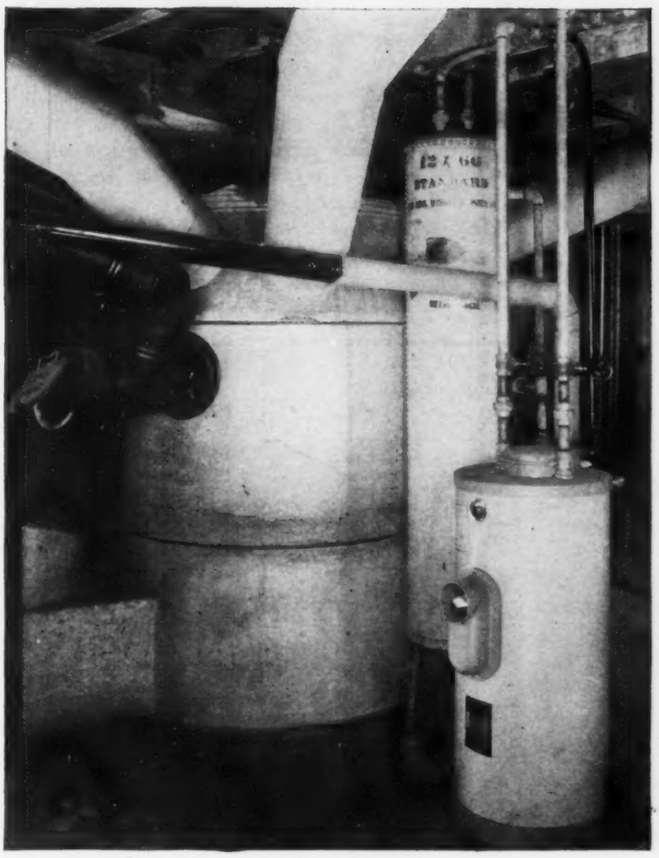
The average number of people in the families served by the heaters under test was 4.1, which is not far different from the U. S. Census Bureau figure for the number of people comprising the average American family. The average monthly consumption of hot water was 1,230 gal. per family, which is equivalent to 10 gal. per person per day.

In so far as the above described collection of water heaters represents average conditions, the results of this test will indicate the average results to be expected.

The heaters on test



Furnace heat can be used for water in winter

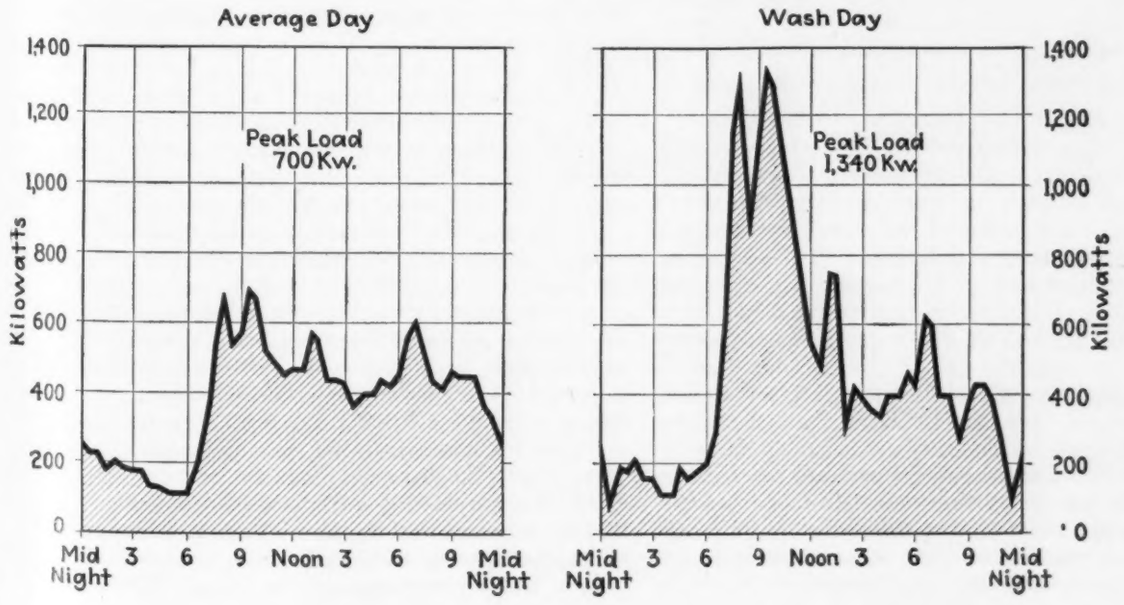


A 10-gal., 3-kw. electric water heater

were equipped with special integrating watt-hour meters which measured the total consumption of electrical energy; a considerable number of the heaters were also equipped with special water meters which measured the total amount of hot water delivered by the heaters, and there were installed from time to time curve-drawing ammeters for determining the load characteristics, from which some 900 load curves were obtained. No attempt was made to determine the average temperature of the water delivered to the heaters except that the Detroit Water Board reports an annual average temperature of 53 deg. F. for the water pumped through its mains. The temperature of the hot water delivered by the heaters was not measured, but was determined roughly by the setting of the thermostats controlling the operation of the heaters. In general, these thermostats were so adjusted that temperatures in excess of 160 deg. F. were avoided because the precipitation of solids in the water may become troublesome at higher temperatures.

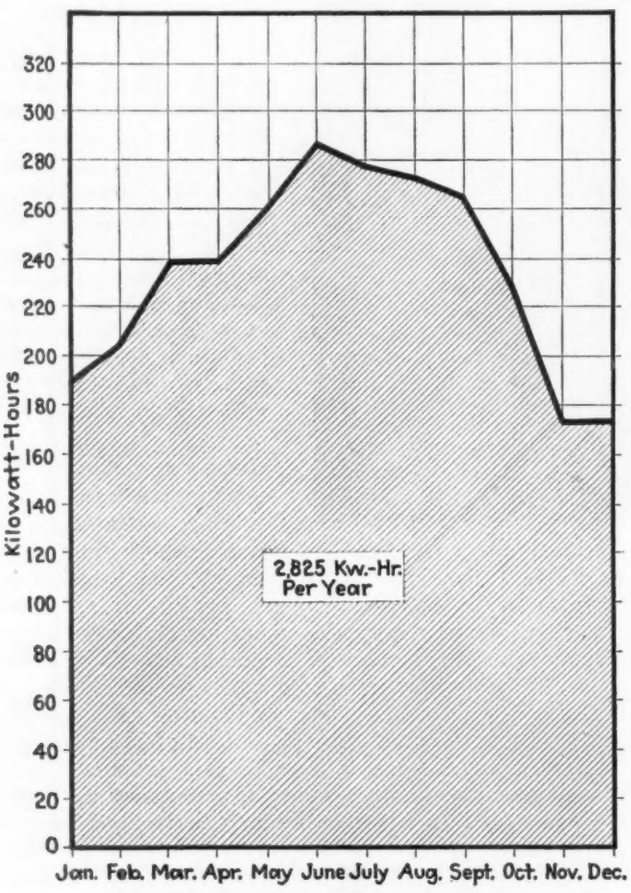
Energy savings may be effected at the expense of service. People who use manual control simply get along with less hot water. In the heaters under test eight with manual control used an average of 1,720 kw.-hr. per year; while seventeen under full automatic operation used an average of 3,430 kw.-hr. per year. Of course the gallons of hot water furnished by the heaters were reduced by manual operation in approximately the same proportion.

The consumption of electric energy in a water heater may also be very considerably reduced during the winter time by feeding it with reheated water from a hot water coil in the regular house-heating furnace. Under ordinary conditions an electric water heater will heat about 4 gal. of water for each kilowatt-hour consumed. A heater fed with preheated water from an effective furnace coil may at times triple its output of hot water per killowatt-hour, increasing it to 12 gal. This results in economy of operation, because the water may be heated more cheaply in the furnace than by electricity. In such



Daily loads of 1,000 electric water heaters

arrangements the heater simply acts as a booster to the furnace coil and as a standby to meet exceptionally heavy demands for hot water. Test results showed that nine heaters without furnace connections consumed an average of 3,475 kw.-hr. per year, while sixteen heaters with furnace connections consumed an average of 2,438 kw.-hr. per year. If a furnace coil is used as an aid to an electric water heater care must be exercised to see that the coil is properly connected. There should be the usual uninsulated tank between the coil and the



Annual energy consumption of an electric water heater

electric heater to dissipate excessive heat from the coil, and provision should be made to prevent the local circulation of hot water between the heater and the bare tank.

Practically all of the energy of the electric current goes to heat the water with very little loss. The losses arise from the radiation of heat by hot water standing in the heater and in the service pipes in the house and, to a lesser extent, by the loss of hot water through leaking faucets.

High storage heaters with their larger radiating surfaces are a little less efficient than the high-wattage type, with its smaller surfaces. Under the service conditions of this test about 70 per cent of the heat generated by the electric current was delivered in useful form as hot water drawn from the faucets. The mechanical remedies for losses are adequate insulation, heat traps to limit the thermo-siphon circulation of water in the pipes and leakage by-passes to furnish only cold water to leaky faucets.

Losses under service conditions may be approximately calculated in two ways. The killowatt-hour input to the heater was known exactly, as was the number of gallons of water passing through the heater. The temperatures of the incoming water and of the water as it comes from the faucets were also known approximately. The useful heat may be calculated from the volume of water and the change in temperature, and this value may be compared with the energy in killowatt-hours used by the heater. The second calculation is made from the composite load curve. Between 4 and 6 o'clock in the morning it may be assumed that practically no hot water is being used and that the electrical input to the heaters at this time is for the sole purpose of supplying radiation losses and that it is the measure of such losses.

Load characteristics determined

A composite load curve was prepared from the 900 curve-drawing ammeter charts taken during the test. It may be assumed with a fair degree of accuracy that such a curve will approximate the load curve resulting from the simultaneous operation of 900 electric water heaters.

The peak of the electric water heater load occurs in the morning between 8 and 9:30, when uses in lavatories and kitchens are at their height. There is a considerably smaller peak when lunch dishes are washed at 1 p.m. and another peak after dinner at 7 p.m. Baths constitute an important use of hot water, but no bath peak is discernible because the times of taking them are so diverse.

By far the heaviest use of hot water is at the time of doing the family washing, which is quite generally standardized on Monday morning, and if the heater will meet service requirements at this time it will in all probability be adequate at all other times. A composite load curve for washdays alone shows a maximum demand of 1,310 watts, as compared with the maximum demand of 680 watts for the average of all days in the week.

The most important thing to be learned from the composite load curve is an understanding of the very high diversities which are characteristic of the electric water-heating load when a large number of the heaters are of the high-wattage type. The average rating of the water heaters on test was 3,600 watts and every heater at one time or another was on the line for its full rated capacity, yet the composite load curve shows a peak of only 680 watts, giving a diversity between individual heaters of 5.3. In addition to this, the water heater load between 4 and 6 o'clock in the afternoon was reduced to a little more than 400 watts per heater, and if allowance be made for the fact that the winter consumption of water heaters is markedly less than the summer consumption the composite water heater load between 4 and 6 p.m. on a December afternoon will probably not exceed an average of 320 watts per heater. Assuming that the system peak load occurs on a December afternoon, a large group of electric water heaters having individual demands reaching 3,600 watts per heater will not be on the peak for more than 320 watts per heater, giving the very large total diversity of 11.2.

The diversity found in these tests arose from the fact that the heaters were capable of heating the water needed by the households without being in operation for more than a small percentage of the time. Assume that a

household requires 1,200 gal. of water each month to be heated from 50 deg. F. to 150 deg. F. At 75 per cent efficiency for the heater this will require 390 kw.-hr., which may be supplied by either a 550-watt heater running continuously or by a 5-kw. heater running a little more than 2½ hours a day. In the case of the 550-watt heater there will be a very high load factor but no diversity at all, while for the 5-kw. heater the diversity factor will be quite high, 6 or 8, but the load factor will be lower. It makes only a little difference at the power house whether high-wattage or low-wattage heaters are used, but the high-wattage heaters require heavy interior wiring, metering and distribution lines because the compensating diversity does not become effective until the source of supply for a large group of heaters is reached.

The Monday morning heater peak is considerably larger than the average peak for all the days of the week, but against this is the fact that, in general, system maxima do not occur on Monday mornings, so that this peak is not a particular source of worry.

The month-by-month consumption of energy by the group of water heaters under test averaged 235 kw.-hr. per month. There is, however, a pronounced seasonal shape to the annual curve, because the three summer months averaged 280 kw.-hr. per month and the three winter months 190 kw.-hr. per month. While the consumption of electricity is low in the winter time, the consumption of hot water is greater in the winter time than it is in the summer, by some 30 per cent. The fact that more water is heated in the winter time with fewer kilowatt-hours is explained by the very substantial help given to the heaters by the furnace coils during the winter time, when 1 kw.-hr. will heat 7 gal. of water, while it will heat only 4 gal. of colder water furnished direct to the heaters from the water mains in the summer time.

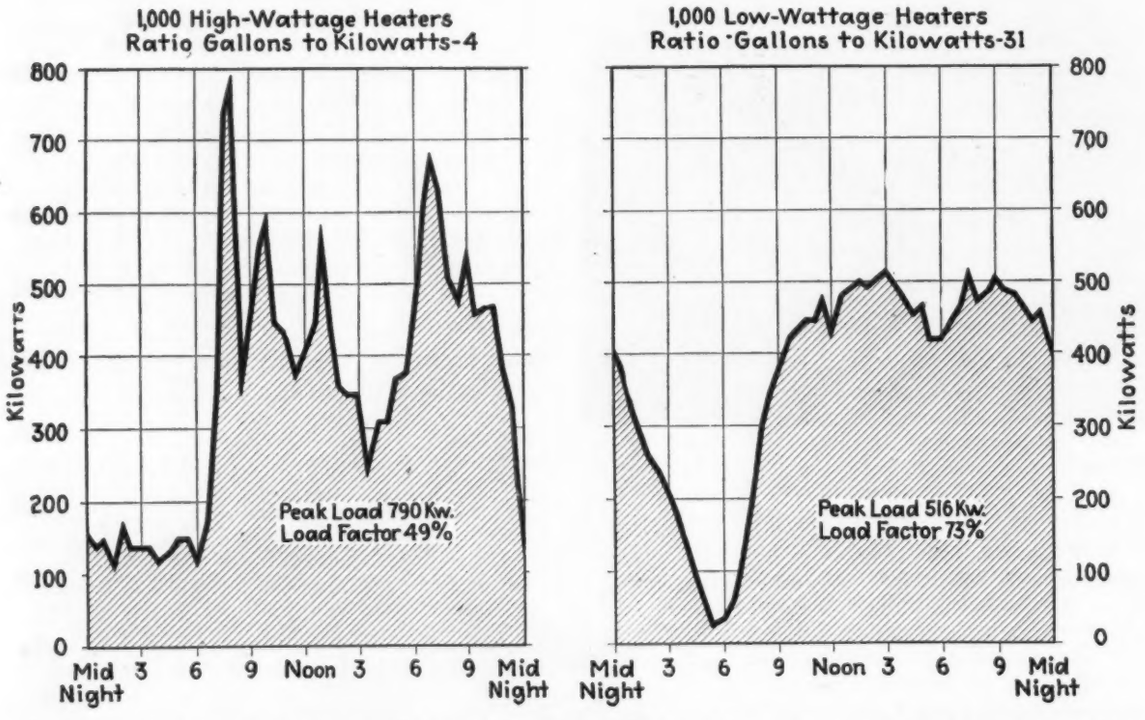
Two of the heaters under test were entirely turned off during the winter time and all of the water was heated by the furnace loop; the other heaters were used during the winter, but their work was greatly lessened. Electric water heaters connected in series with a furnace loop are distinctly a summer load, at least in localities with the weather conditions which prevail in Detroit, and because of this characteristic they tend to fill in the low point in power plant output that occurs in the summer time. The annual consumption per heater was 2,825 kw.-hr., more than five times the annual consumption of an average residence customer for lighting and small appliance uses, estimated at about 500 kw.-hr. per year. It is about twice the consumption of the average electric range, 1,480 kw.-hr. per year, and is very much more than the requirements for an electric refrigerator, 540 kw.-hr. per year, or for an oil-burner motor, 260 kw.-hr. per year. The electric water heater is the most potent single means of building up the consumption of current by residence customers. In fact, the electric water heater consumes so much energy that the cost of operation to the customer becomes a possible stumbling block, and the service cannot become widely popular unless suitable low rates are available.

The composite load curve for the electric water-heating load has a good load factor, about twice as high as that for the composite load curve for electric range service and much better than the load factor for ordinary lighting service. The heater curve and the range curve exhibit about the same composite peak, but the electric water heater consumes nearly twice as many kilowatt-hours as does the electric range. The fundamental reasons for the good load factor of electric water heating are the possibility of storing hot water, whereas cooking and lighting must be done as needed, and the more general use of hot water throughout the day and evening, whereas cooking is sharply concentrated at mealtimes and lighting during the evening hours.

Such homes as these are good prospects for electric water heating

Test results indicate that the composite load factor of a large group of low-wattage heaters is better than the composite load factor of a large group of high-wattage heaters. This means that the high diversities found among high-wattage heaters do not entirely compensate their high individual demands; 377 load curves on high-wattage heaters (average ratio of gallons to kilowatts 4) showed a composite daily load factor of 49 per cent, while 200 load curves on low-wattage heaters (average ratio of gallons to kilowatts 31) showed a composite daily load factor of 73 per cent. The average composite daily load factor of all heaters on test was 57 per cent.

The high-wattage load curve tends to reflect the house-hold needs for hot water, which are not uniform throughout the day; the low-wattage load curve tends toward uniformity of load, with the variations of use of hot water taken care of by the storage.



COMPOSITE DAILY LOAD CURVES OF TWO TYPES OF ELECTRIC WATER HEATERS

High wattage vs. low wattage

There is much discussion as to whether high-wattage, low-storage or low-wattage, high-storage water heaters are best for the customer and for the utility. The high-wattage heater is cheaper in first cost, it is more compact and a little more efficient than the low-wattage heater, and it may be used with manual control. On the other hand, the low-wattage heater has a somewhat better load factor, and it does not require the heavy wiring and metering that the high-wattage heater requires, but it is too slow for use with manual control. Because of the high diversity in the composite water heater load the heavy demands of high-wattage heaters are confined for the most part to the house wiring, the meter and the secondary distribution system. If the secondary distribution system has been designed for service to electric ranges, it will be equally capable of serving reasonably high-wattage electric water heaters and there is little to choose between the two types of heaters. If, however, the house wiring and the secondaries have to be bolstered up to carry ranges, they will also have to be bolstered up to serve high-wattage heaters, and under such circumstances the low-wattage type of heater may be preferable.

Some of the heaters on test were equipped with heating elements split into two or three sections and so arranged that most of the heating was done by one section, the other sections only cutting in when the heater was pretty well drained of hot water. A high-wattage heater so constructed is very similar to an electric range in its power requirements, but since it consumes about twice as many killowatt-hours as does the range it has a very much higher load factor and is a more desirable load. A split-element heater has the advantage over the single-element heater in that it comes onto the line in steps, so that voltage flickers are less noticeable in customers' lamps, and that since the heater is on full only on rare occasions a somewhat larger voltage drop is permissible.

In this test the electric heaters averaged, month in and month out, 5.4 gal. of hot water per kilowatt-hour. Tests made simultaneously on five gas water heaters served with 530 B.t.u. gas by the gas division of the Detroit Edison Company showed that 1,000 cu.ft. of gas will heat 331 gal. water. We believe that this figure is somewhat low and that 1,000 cu.ft. of 530 B.t.u. gas will heat 400 gal. of water under service conditions in the ordinary home. This means that 1,000 ft. of 530 B.t.u. gas burned in a gas water heater will do the same work that 74 kw.-hr. will accomplish in an electric water

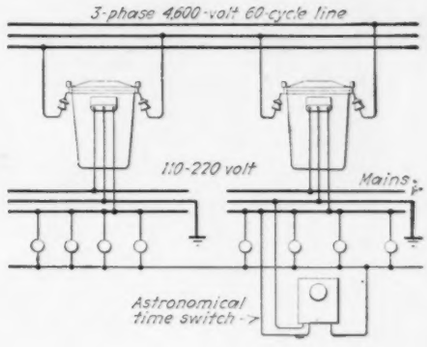
heater, so that electricity at 2 cents per kilowatt-hour is equivalent in cost to gas at $1.48 per 1,000 cu.ft. The average family requires about 1,200 gal. of hot water a month, and at 2 cents per kilowatt-hour this would result in a monthly bill for electric water heating of about $4.50 per month.

Very favorable report

The mechanical performance of the electric heaters under test was excellent. Repairs and service adjustments were very few.

The use of electricity by residence customers is increasing steadily and rapidly and it has not yet approached the limit of its growth. Lighting and small appliances require in the neighborhood of 500 kw.-hr. a year and this will increase somewhat. To this modest requirement an electric refrigerator will add 540 kw.-hr. per year, an oil burner 260 kw.-hr. per year, an electric range 1,480 kw.-hr. per year and an electric water heater 2,800 kw.-hr. per year, giving a total of 5,580 kw.-hr., or about nine or ten times present requirements. Such a figure seems fantastic, and yet all of the major appliances are practical and useful, and twenty years from now they may be considered as necessities of an up-to-date household, just as the motor car and the radio have taken their places in American life. Problems of cost remain to be worked out, but it behooves the electric utilities to plan residential distribution systems capable of carrying substantial loads and rate structures that take account of the economies possible in supplying relatively large quantities of energy at good load factors to residential customers.

Economical Method of Street Light Control



A CONVENIENT and low-cost method of supplying incandescent street-lighting service from local 110-220-volt secondary mains having a grounded neutral is illustrated herewith. The grounded neutral wire of any lighting group is connected through the switch of the control device and thence to a common control wire from which various lamps are energized in parallel. The street lamps are installed with the ordinary street brackets and fixtures and the scheme is particularly useful, according to A. L. Pierce, manager of the Wallingford (Conn.) Borough Electrical Works, in street lighting in connection with rural line extensions.

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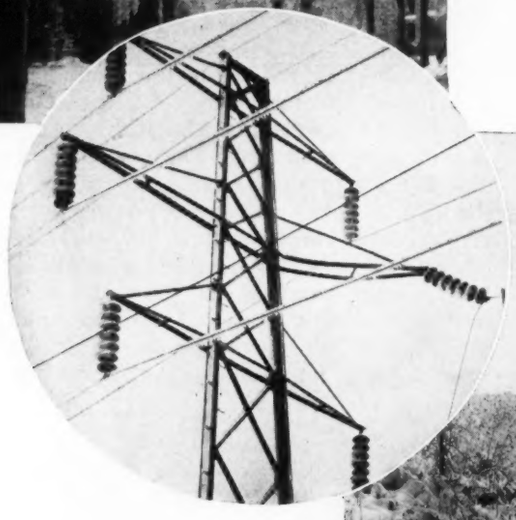
NEW HYDRO PROJECTS* UNDER FEDERAL LICENSE

Based on Report as of November 1, 1929.

Project No.	Name	Stream	State	Proposed Ult. Installation Hp.	Estimated Cost	Scheduled Date of Completion
20	Utah Power & Light Co.	Bear River	Idaho	70,000	$8,831,000	7- 1-36
57	Columbia Valley Power Co.	Deschutes River	Oregon	185,000	15,000,000	6-15-36
67	Southern California Edison Co.	San Joaquin River	California	385,000	60,000,000	12-31-39
77	Snow Mountain Water & Power Co.	South Eel. River	California	14,400	6,665,000	7- 1-29
120	Southern California Edison Co.	San Joaquin River	California	195,000	13,890,000	12-31-29
135	Portland Electric Power Co.	Clackamas River and Oak Grove Creek	Oregon	85,000	9,736,000	5- 7-36
137	Pacific Gas & Electric Co.	North Fork Mokelumne	California	42,000	8,291,000	12- 1-30
175	San Joaquin Light & Power Corp.	West and North Forks Kings River	California	556,000	50,970,000	7- 1-36
184	Pacific Gas & Electric Co.	South Fork American	California	112,000	8,922,000	12-31-35
201	Town of Petersburg	Crystal Lake	Alaska	1,240	115,000	12-31-29
232	Mt. Shasta Power Corp.	Pit River	California	120,000	14,924,000	12-31-31
271	Arkansas Power & Light Co.	Ouachita	Arkansas	96,000	8,055,000	7- 1-36
350	Anchorage Light & Power Co.	Eklutna	Alaska	2,600	240,000	12-31-30
432	Carolina Power & Light Co.	Big Pigeon	North Carolina	105,000	11,900,000	12-31-33
459	Union Electric Light & Power Co.	Osage	Missouri	135,000	14,100,000	6-30-32
516	Lexington Water Power Co.	Saluda	South Carolina	260,000	24,000,000	12-31-30
553	City of Seattle	Skagit	Washington	240,000	30,000,000	12-31-35
567	East Bay Municipal Utility District	Mokelumne	California	20,000	7,922,000	12-31-31
659	Crisp County	Flint	Georgia	16,000	1,200,000	12-31-35
663	Porto Rico Railway Light & Power Co.	Blanco	Porto Rico	7,000	900,000	21-31-30
682	West Florida Power Co.	Ochlockonee	Florida	12,000	2,100,000	8-23-29
798	Savannah River Electric Co.	Savannah River	Georgia and S. Car.	120,000	19,000,000	2- 7-33
906	Hydro-Electric Corp. of Virginia	James River	Virginia	6,000	625,000	12-31-29
				2,785,240	$317,386,000	

*The table lists only projects of 1,000 hp. or larger. Including smaller projects the whole number is 55; 2,789,231 hp.; $317,961,380. Of the total there is scheduled for completion in 1929, 72,623 hp.; in 1930, 293,015 hp.; in 1931, 420,468 hp.

SLEET—An Unconquered Foe



Typical sleet formation on transmission and distribution lines

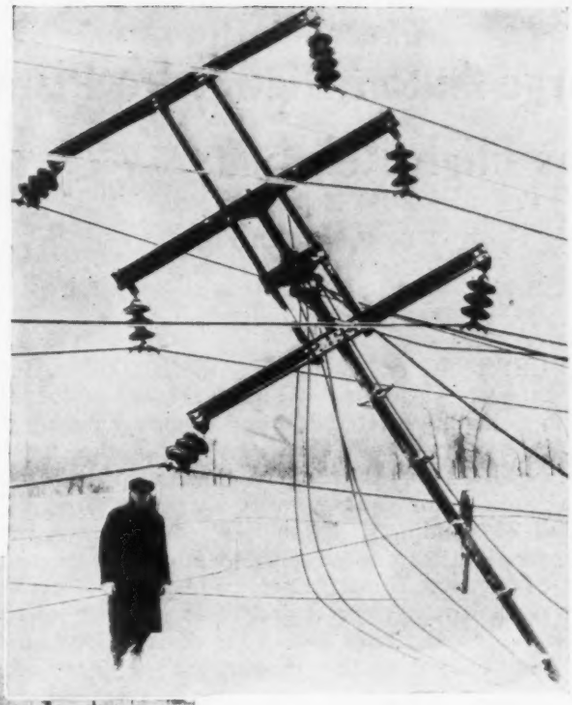
"Better to yield than fall" was the experience on the tower shown in the circle, for the semi-flexible crossarm moved to accommodate the broken conductor, but left the tower and other wires intact.

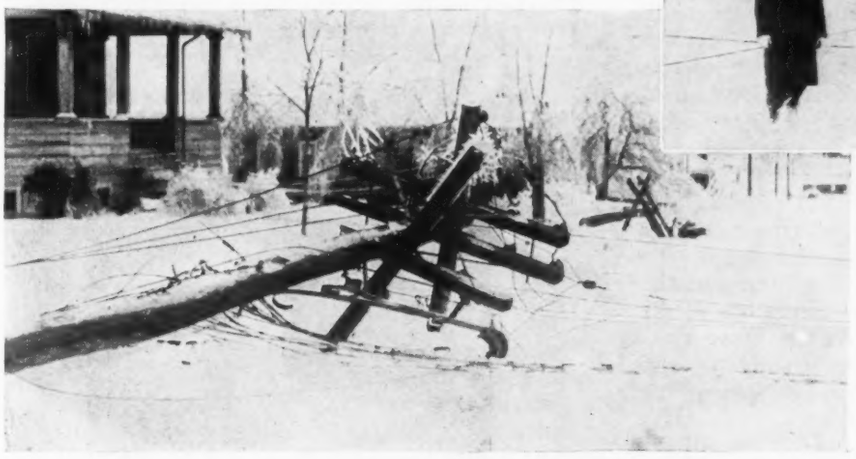
The burden of ice on conductors, transformers, poles, crossarms and trees whose branches added impossibly heavy loads brought disaster to construction ordinarily more than adequate. Trees caused the eastern New York men far more difficulty than the overloading of the lines themselves.

Nine tall towers in succession was the Grand Island toll

Collapsed structure in this view is the second suspension tower from the river. Ground conditions made re-erecting exceedingly difficult, although spare material was at hand for early replacements.

THE disastrous storms of December 16-21 which raged erratically across the lake district, New York and New England from the west brought transmission lines, distribution circuits, telephone facilities and transportation to suspended service. As reported in ELECTRICAL WORLD for December 28, 1929 (pages 1288-1290), the damage was unprecedented in its extent and only after a terrific struggle was service restored by Christmas in many localities. Sleet, which overburdened conductors and supports and crushed ice-ladened branches against the lines, was the worst of the power man's troubles.



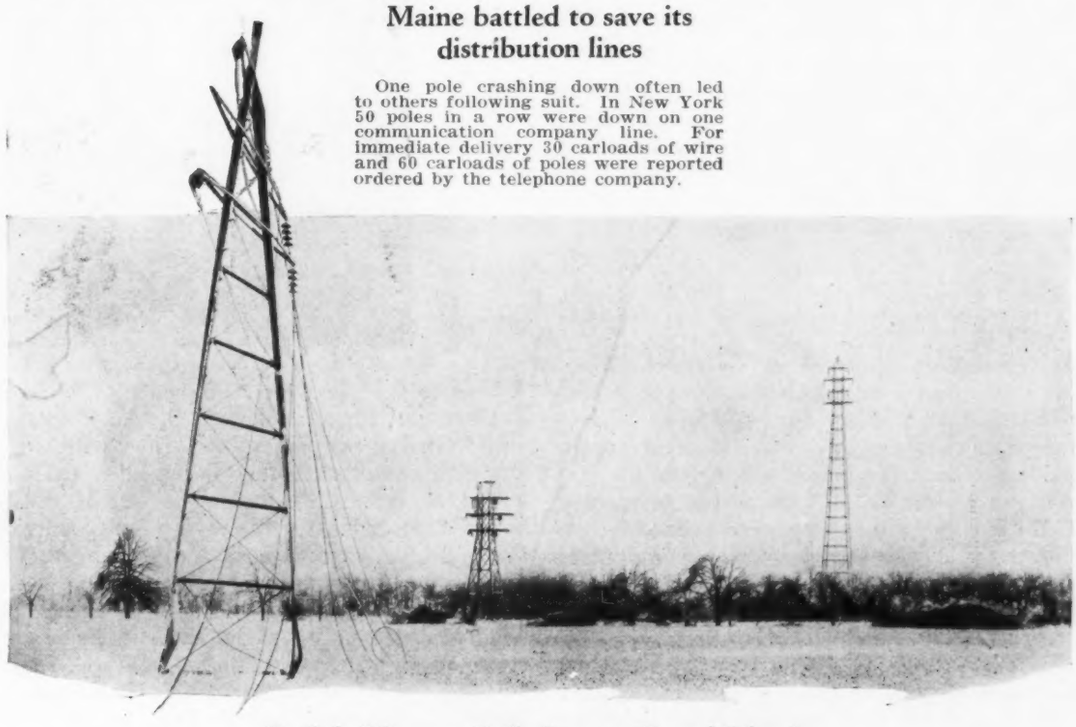


Tubular steel pole as left by failure under sleet-loading

A Canadian line which succumbed to the worst storm that power men can recall, although sleet and ice are no novelty in this territory.

Maine battled to save its distribution lines

One pole crashing down often led to others following suit. In New York 50 poles in a row were down on one communication company line. For immediate delivery 30 carloads of wire and 60 carloads of poles were reported ordered by the telephone company.



Buffalo-Niagara Falls line on Grand Island

River crossing and anchor towers stood fast, but suspension members yielded to the tremendous overload of the ice-coated conductors

Large Automatic Hydro Plant Has High Reliability

By C. W. COLVIN
Engineering Department,
British Columbia Electric Railway Company, Ltd.,
Vancouver, B. C.

OPERATING experience with the 10,000-kva. fully automatic Alouette hydro-electric plant of the British Columbia Electric Railway Company during the first year's operation has shown full justification for the extra expense incurred in providing the additional equipment required for full automatic operation. Out of a total of 21 shutdowns, fifteen were emergency and six automatic, but not one was due to failure of the automatic equipment. From the service point of view, automatic operation has been entirely successful.

The single generating unit in the Alouette plant consists of a vertical shaft turbine capable of developing 12,500 hp. (effective rated output under average head), direct connected to a 10,000-kva., 80 per cent power-factor generator. Its normal starting and stopping signals are given by closing or opening an oil circuit breaker at Stave Falls generating station, 10.5 miles distant, the circuit breaker named being the one that connected the Alouette-Stave Falls 66,000-volt transmission line to the Stave Falls bus. When signals are given at Stave Falls generating station, Alouette automatically starts up and synchronizes itself with the transmission system, or shuts down, depending on the signal given.

The station was first started, for purposes of adjustment of automatic equipment and for test, on May 11, 1928. It is of interest to know that during adjustments and tests complete efficiency tests were made.

The station was not required for production of commercial load until August 15, 1928, and on that date it was first put into active service. The data following refer to the calendar year August 15, 1928, to August 14, 1929:

Total hours running	6,003½
Total kilowatt-hours produced	46,937,800
Power-factor range	98 per cent lagging to 96 per cent leading
Plant load factor in per cent	59.5
Maximum peak load in kilowatts	10,300
Number of emergency shut-downs	15
Number of automatic shut-downs	6

The term "emergency shut-downs" refers to times when, due to some trouble or impending trouble, it was deemed advisable to shut down for repairs or adjustments. At such times the shut-down was prearranged, i.e., the load despatcher gave permission before the station was taken out of service. Of the fifteen emergency shut-downs, thirteen were due to governor driving belt trouble. This trouble was finally overcome and there have been no outages due to this cause since December 4, 1928. Broken links on turbine gates were the cause of the remaining two outages under this heading.

Of the six "automatic shut-downs," i.e., those when the station protective equipment operated and caused the station to shut down, one resulted from lightning on the transmission line, three resulted from short circuits in the transmission system, one was the result of generator differential relay action, when a lamination clamping finger became loose and pierced the insulation, and one was caused by a bad synchronizing operation due to the governor belt trouble mentioned previously. It will be noted that in no case was any emergency or automatic shut-down attributable to improper functioning of any of the automatic equipment. On the contrary, the various devices have performed the functions expected of them with probably more certainty and expedition than would have resulted through manual operation.

One competent maintenance man is resident close to the station, and while he is frequently present at prearranged starting and stopping, he takes no part in the operation. Regular inspection is made every two weeks, during which relays, instruments, etc., are cleaned and any adjustments that may be necessary are made.

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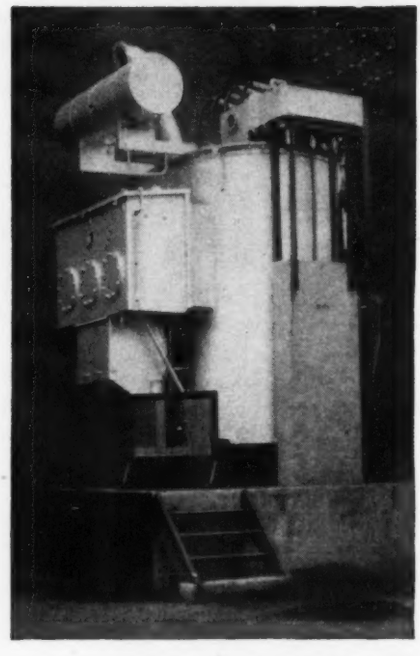
Utilizing Yard Corner for 10,000-Kva. Transformer



IN A corner between two walls of a reserve steam plant an Eastern power company has installed a 10,000-kva., three-phase transformer with automatic tap-changing equipment which occupies no more space than a bank of three 1,500-kva., single-phase transformers in an adjacent portion of the yard. Both banks tie a 22-kv. line into the local system and participate in a vitally important interconnection. A mirror mounted on the transformer foundation at an angle to the approaching and receding roadways facilitates safe automobile operation around the turn. Back of the concrete walls forming the pier is a reservoir for transformer oil dumping in emergencies, with grating top which enables the structure to be used as a platform in inspection and maintenance.

Electric Stereotype Pots Melt 1,000 lb. with 20 Kw.-Hr.

By J. L. FADEN
Industrial Heating Engineer
Edison Electric Illuminating Company of Boston

DURING the past four years rapid progress has been made in electric stereotype pot applications in the newspaper industry and on September 1, 1929, some 100 publishing companies had in operation 150 pots ranging in capacity from 1 to 9 tons and representing 14,300 kw. connected load. The usual composition of stereotype metal is 5.6 per cent tin, 14.1 per cent antimony and 80.3 per cent lead. Machine methods of plate casting are becoming widely used, automatic casting pumps operating at a speed as high as four plates per minute. Constant availability of molten metal for casting is essential in metropolitan papers. A representative installation serving the Boston *Globe* superseded a gas-heated outfit.

The stereotype foundry of this paper is completely electrified. There are two 8-ton melting pots, each equipped with 300 kw. in heating units (30 units rated at 10 kw. each per pot). The operating temperature of each pot is maintained at 650 deg. F., with three circuits which are thrown into service as required by automatic temperature control. When a pot is idle it is held at 650 deg. by one circuit with the heaters arranged in series connection. Figs. 1 and 2 show demand curves of this installation by half-hour intervals. Fig. 1 records the input of the total plant electrical equipment and of the stereotype pots on Sunday, May 26, 1929, and Fig. 2 shows that for the following Tuesday, a week-day.

A study of these and other charts covering a week's run brought out several interesting facts. The total maximum half-hour demand of the pots occurred early Sunday morning and amounted to 275 kw. At this time, however, the plant load amounted to only 200 kw. The maximum demand for the total load for the week did not exceed 525 kw. At the time this maximum was reached the total demand of the two pots was 112 kw. and the plant demand 413 kw.

It is evident that there is considerable diversity between the maximum electrical demand of the pots and that for power and light. Curve A on Fig. 1 shows the

Table I—Typical Week of Stereotype Casting

		Edition	
		A.M. Plates	P.M. Plates
Sunday,	September 8	1,776	.....
Monday,	September 9	252	698
Tuesday,	September 10	335	781
Wednesday,	September 11	225	758
Thursday,	September 12	336	803
Friday,	September 13	384	1,082
Saturday,	September 14	238	908
		3,566	5,030
			3,566
Total plates cast			8,596

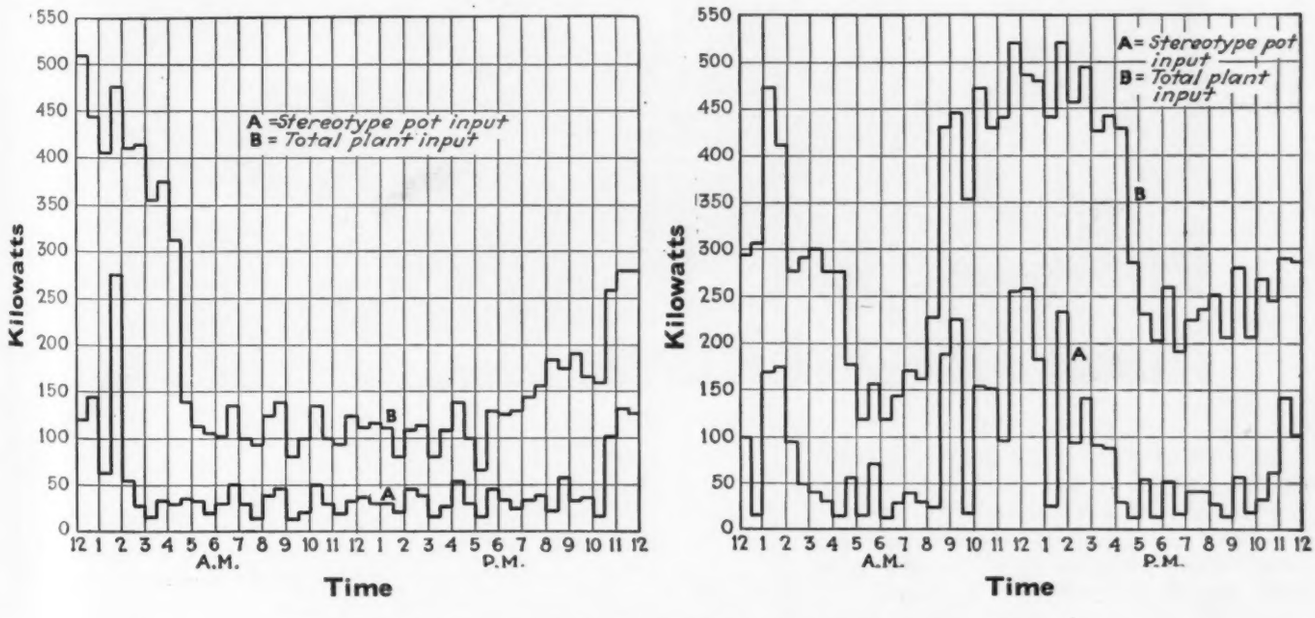
September 8 to 14 = 12,460 kw.-hr.

Average weight per plate 71.8 lb. $8,596 \times 71.8 = 616,000$ lb.
Energy consumption per 1,000 lb. = 20.2 kw.-hr.

Table II—Approximate Schedule of Stereotype Metal Casting

	Day	Night
Monday	9.00 a.m. to 3.30 p.m.	9.00 p.m. to 2.30 a.m.
Tuesday	9.00 a.m. to 3.30 p.m.	9.00 p.m. to 2.30 a.m.
Wednesday	9.00 a.m. to 3.30 p.m.	9.00 p.m. to 2.30 a.m.
Thursday	9.00 a.m. to 3.30 p.m.	9.00 p.m. to 2.30 a.m.
Friday	9.00 a.m. to 3.30 p.m. also 4.30 p.m. to 5.30 p.m.	9.00 p.m. to 2.30 a.m.
Saturday	9.00 a.m. to 6.00 p.m. (continuous)	
Sunday	.....	9.00 p.m. to 2.30 a.m.

FIGS. 1 AND 2—LOAD CURVE OF NEWSPAPER PLANT ON TYPICAL SUNDAY AND TUESDAY



electrical input to the two pots when the temperature was being maintained at approximately 650 deg., but plates were not being cast. This standby period extended from 2 a.m. to 10 p.m. The total electrical consumption for this period was 586.5 kw.-hr.

From these figures it is evident that the average kilowatt demand per hour is 29.3. Therefore the radiation loss of each pot is approximately 14.7 kw. per hour.

Table I gives a record over a more recent week of the number of plates cast for the morning and afternoon editions. During this period 8,596 plates were cast with an electrical consumption of 12,460 kw.-hr. The average gross weight per plate is 71.8 lb., therefore the total amount of metal that was cast during this week amounted to 616,000 lb. This gives an average energy consumption per 1,000 lb. of metal cast of 20.2 kw.-hr.

In addition to the two 8-ton stereotype pots described above, there is a 2½-ton pot equipped with 20 kw. of heating capacity. This last pot is used for miscellaneous work, including the casting of flat plates.

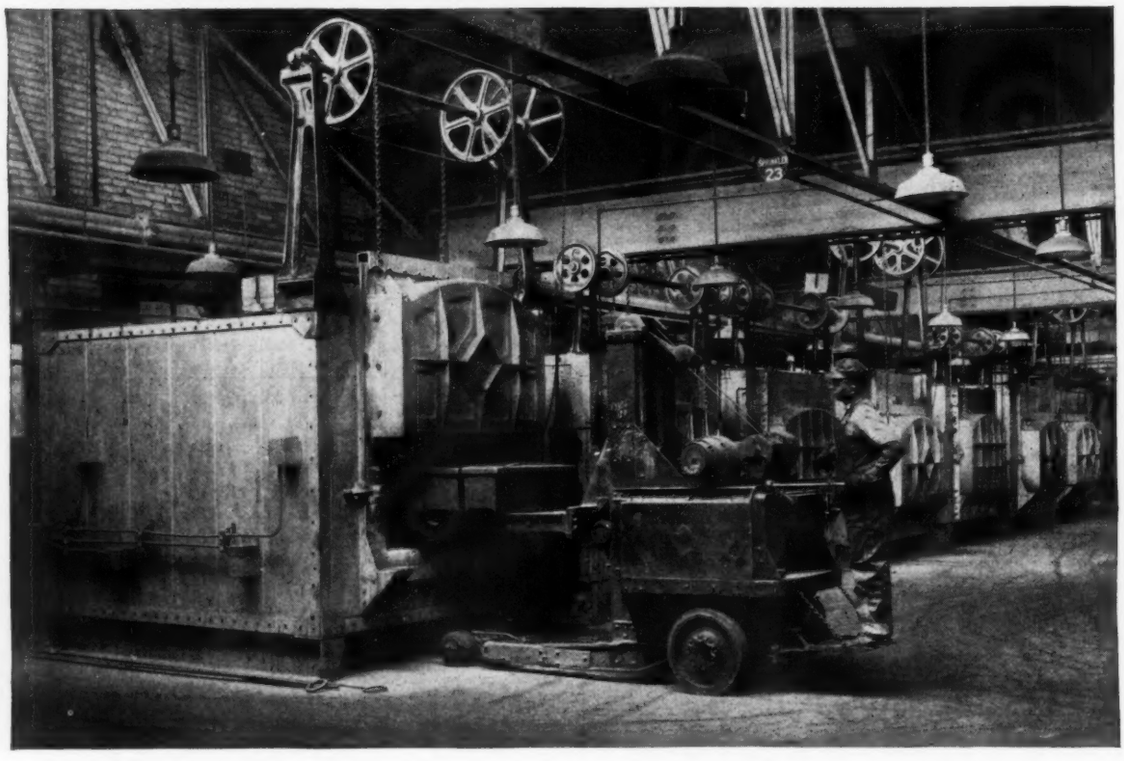
Electrically heated scorchers are used for drying the mats. Six curved scorchers are each equipped with 2 kw. maximum heating capacity and two rotary scorchers are each equipped with 5 kw. All of the scorchers have three-heat switches.

The heating units and control equipment were supplied by the General Electric Company, the temperature instruments by the Bristol Company, the curved scorchers by the Speed Products, Inc., and the rotary scorchers by J. W. Cemer.

▼ ▼ ▼

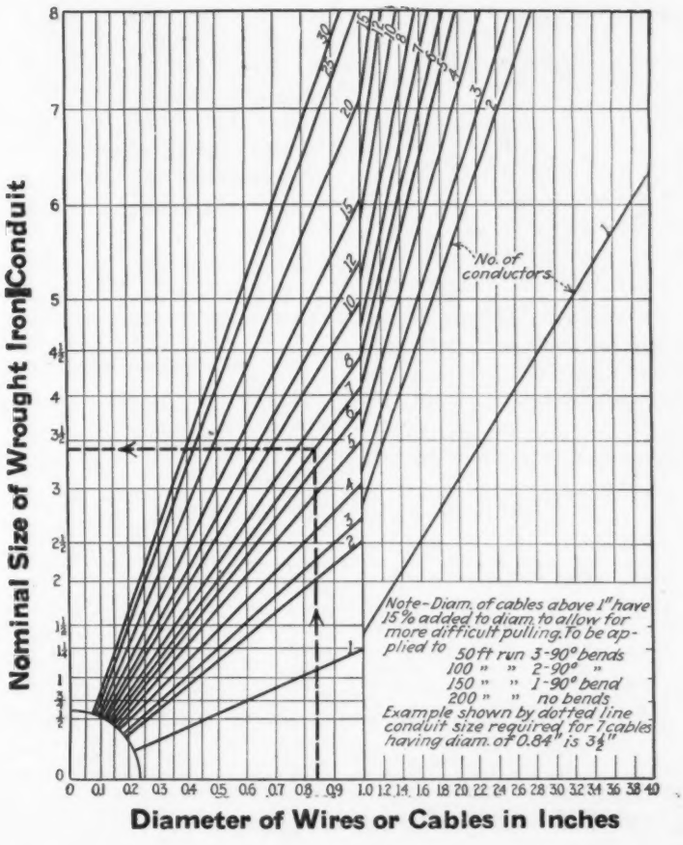
Industrial Heat Market Comparable to Present Power Load

	1926	1929
Total energy sold for industrial purposes (kw.-hr.)	**36,000,000,000**	**51,000,000,000**
Energy sold for industrial heat (kw.-hr.)	**4,150,000,000**	**5,900,000,000 (est.)**
Potential market for electric heat (estimated)	**93,427,000,000**	



In 1928 fifteen utilities sold 922,000,000 kw.-hr. for electric heat, or 10 per cent of their total power sales. One company's sales totaled 39 per cent. According to the N.E.L.A. industrial heating committee, which furnished these company figures, industrial heat sales for 1929 should be 16 per cent higher, or 1,069,000,000 kw.-hr. based upon planned activities and commercial prospects.

What will other companies do to promote electric heat for heat treating, ovens, melting pots and immersion heaters, forging, vitreous enameling, non-ferrous and ferrous metallurgy, etc.?


Nominal Size of Wrought Iron Conduit
Diameter of Wires or Cables in Inches
No. of conductors
Note-Diam. of cables above 1" have 15% added to diam. to allow for more difficult pulling. To be applied to 50 ft run 3-90° bends
100 " " 2-90° "
150 " " 1-90° bend
200 " " no bends
Example shown by dotted line conduit size required for 7 cables having diam. of 0.84" is 3½"

For determining wire or cable capacity of conduit

Conduits for Cable Groups

By KENNARD PINDER

Du Pont Engineering Company, Wilmington, Del.

THE determination of correct conduit sizes is important in laying out power stations, substations, duct runs, etc. It is often desired to install wires or cables of different diameters in the same conduit and the computation of the minimum safe conduit sizes for wires and cables for practically all installations can be quickly made by the use of the accompanying tables and data with a small amount of calculation. The tables apply to multi-conductor cables as well as single-conductor cables.

The nominal size of the conduit to be installed for a run is based on the following conditions: Up to 50 ft. with three 90-deg. bends, 100 ft. with two 90-deg. bends, 150 ft. with one 90-deg. bend and not more than 200 ft. with no bends. If the conduit run is not one of the conditions specified necessary allowances should be made according to each case. In general, if the condition is more difficult, areas which the cables may occupy should be increased to 132 per cent, and if less difficult decreased to 76.5 per cent. In all cases where the diameters of the cables are greater than 1 in., their areas should be increased to 132 per cent to allow for more difficult pulling.

The accompanying tables and data may also be used for 2-in. or larger fiber conduits, as the inside diameter of iron and fiber conduits is practically the same for these sizes.

When it is desired to find a conduit size for various combinations of cables of different diameters select from Table III the areas for different diameters and multiply by number of cables of like diameter for each group of like diameter, add the groups together and select the conduit size from Table II.

Table II is based on the proportion of the area of the conduit which may be occupied by cables for a given condition. One wire or cable may occupy 56 per cent

Table I—Conduit Data

Conduit Size, Inches	Inside Conduit Diameter	Conduit Area	Conduit Size, Inches	Inside Conduit Diameter	Conduit Area
¾	0.622	0.305	3	3.068	7.39
⅞	0.824	0.533	3½	3.548	9.89
1	1.049	0.866	4	4.026	12.73
1¼	1.380	1.50	4½	4.506	15.96
1½	1.610	2.04	5	5.047	19.99
2	2.067	3.36	6	6.065	28.89
2½	2.469	4.78			

of the area of the conduit; two cables, 32 per cent; three cables, 42 per cent; four cables, 40 per cent, and five or more cables, 37 per cent.

Example: Determine the conduit size for a run of 100 ft., two 90-deg. bends for two cables having a diameter of 0.88 in., three cables having a diameter of 1.05 in. and four cables having a diameter of 0.52 in.

From Table III select the areas of the cables having the above diameters—0.88 in. diameter, 0.608 sq.in. area; 1.05 in. diameter, 0.866 sq.in. area (as the diameter is greater than 1 in. its area should be increased to 132 per cent or 1.16 sq.in. area); 0.52 in. diameter 0.212 sq.in. area.

Multiply by number of cables of each diameter and add $(2\times0.608) + (3 \times 1.16) + (4 \times 0.212) = 5.544$.

From Table II the next largest conduit factor for five or more cables per conduit is 5.90 and the size conduit is 4½ in.

When all of the cables to be pulled into one conduit have the same over-all diameter, the conduit size can be determined by the following method in addition to the previous method. The conditions for the conduit runs are the same as those previously given. If the condition is more difficult, the multiplier given in Table IV should be increased to 115 per cent, and if less difficult decreased to 87.5 per cent. If cable diameter is greater than 1 in. its diameter should be increased to 115 per cent to allow for more difficult pulling.

The relation of the size conduit to the size and number of cables is given in the following formula:

$$D = m \times d$$

Where

D = diameter of conduit in inches.

m = multiplier based on geometrical computations of number of wires or cables in a conduit.

d = over-all diameters of cables.

If n = the number of wires, the relation of m to n is given in Table IV.

Example: Determine the conduit size for a run of 100 ft., two 90-deg. bends for ten cables having a diameter of 0.54 deg.

Multiplier from Table IV for ten cables in one conduit, 4.98.

$$4.98 \times 0.54 = 2.69$$

From Table I the next largest conduit diameter is 3.068 and the size conduit is 3 in.

Some engineers prefer to use charts or graphs instead of tables. Chart I is for determining the size of conduits required for a number of cables having the same diameter.

When all the cables to be pulled into one conduit are flat duplex use the multiplier in Table V and find the size conduit in a similar manner as for those having the same diameter.

TABLE II—CONDUIT FACTORS

No. of Cables	CONDUIT SIZES AND FACTORS, INCHES												
	¾	⅞	1	1¼	1½	2	2½	3	3½	4	4½	5	6
1	0.171	0.277	0.485	0.840	1.143	1.880	2.68	4.14	5.54	7.13	8.92	11.20	16.13
2	0.098	0.170	0.277	0.480	0.653	1.075	1.53	2.36	3.16	4.08	5.10	6.40	9.22
3	0.128	0.224	0.364	0.630	0.856	1.410	2.01	3.10	4.15	5.35	6.70	8.40	12.10
4	0.124	0.213	0.346	0.600	0.815	1.345	1.91	2.96	3.96	5.10	6.37	8.00	11.52
5 and more	0.113	0.197	0.320	0.555	0.755	1.243	1.77	2.73	3.66	4.72	5.90	7.40	10.65

TABLE III—AREAS OF WIRES—0.1 IN. TO 5.0 IN. DIAMETER

Dia.	Area	Dia.	Area	Dia.	Area	Dia.	Area	Dia.	Area	Dia.	Area	Dia.	Area
0.10	0.0078	0.27	0.0573	0.44	0.1521	0.72	0.407	1.15	1.04	2.0	3.14	3.7	10.75
0.11	0.0095	0.28	0.0616	0.45	0.1590	0.74	0.430	1.20	1.13	2.1	3.46	3.8	11.34
0.12	0.0113	0.29	0.0661	0.46	0.1662	0.76	0.454	1.25	1.23	2.2	3.80	3.9	11.95
0.13	0.0133	0.30	0.0706	0.47	0.1735	0.78	0.479	1.30	1.33	2.3	4.15	4.0	12.57
0.14	0.0154	0.31	0.0755	0.48	0.1810	0.80	0.503	1.35	1.43	2.4	4.52	4.1	13.02
0.15	0.0176	0.32	0.0804	0.49	0.1886	0.82	0.528	1.40	1.54	2.5	4.91	4.2	13.85
0.16	0.0201	0.33	0.0855	0.50	0.1964	0.84	0.554	1.45	1.65	2.6	5.31	4.3	14.52
0.17	0.0227	0.34	0.0908	0.52	0.212	0.86	0.581	1.50	1.77	2.7	5.73	4.4	15.21
0.18	0.0254	0.35	0.0962	0.54	0.229	0.88	0.608	1.55	1.89	2.8	6.16	4.5	15.90
0.19	0.0284	0.36	0.1018	0.56	0.246	0.90	0.636	1.60	2.01	2.9	6.61	4.6	16.62
0.20	0.0314	0.37	0.1076	0.58	0.264	0.91	0.665	1.65	2.14	3.0	7.07	4.7	17.35
0.21	0.0346	0.38	0.1134	0.60	0.283	0.94	0.694	1.70	2.27	3.1	7.55	4.8	18.10
0.22	0.0380	0.39	0.1195	0.62	0.302	0.96	0.724	1.75	2.41	3.2	8.04	4.9	18.86
0.23	0.0415	0.40	0.1257	0.64	0.322	0.98	0.754	1.80	2.54	3.3	8.55	5.0	19.64
0.24	0.0452	0.41	0.1320	0.66	0.342	1.00	0.785	1.85	2.69	3.4	9.08		
0.25	0.0491	0.42	0.1385	0.68	0.363	1.05	0.866	1.90	2.84	3.5	9.62		
0.26	0.0531	0.43	0.1452	0.70	0.385	1.10	0.950	1.95	2.99	3.6	10.18		

TABLE IV—MULTIPLIERS FOR NUMBER OF CABLES

Number of wires	n	1	2	3	4	5	6	7	8	9	10	11	12
Multiplier	m	1.35	2.50	2.70	3.10	3.48	3.80	4.12	4.42	4.67	4.98	5.24	5.45
	n	13	14	15	16	17	18	19	20	21	22	23	24
	m	5.68	5.90	6.10	6.30	6.60	6.70	6.70	7.00	7.40	7.40	7.55	7.80
	n	25	26	27	28	29	30						
	m	8.00	8.00	8.18	8.25	8.35	8.50						

Table V—Multipliers for Number of Duplex Cables

No. of cables.. *n*	1	2	3	4	5	6
Multiplier.... *m*	1.3	1.6	2.1	2.3	2.7	2.9

Example: Determine the conduit size for a run of 100 ft., two 90-deg. bends for five duplex cables having the large dimension 0.70 in.

Multiplier from Table V for five duplex cables in one conduit, 2.7.

$$2.7 \times 0.70 = 1.89 \text{ in.}$$

From Table I the next largest conduit diameter is 2.076 in. (2-in. conduit).

To find the conduit size for conductors all of one size, find gage number or circular mils of wire in left-hand column and on same horizontal line under Number of Wires and Wire Factors pick out the wire factor and from Table II the size conduit corresponding to the wire factor. Therefore the usefulness of this table is that it may be used to select the conduit size when wires of different sizes are to be installed in the same conduit. In this case proceed as above (where all wires are of one size) for each size and add the wire factors. Comparing the sum of these factors with the conduit factors in Table II will give the size conduit required. If the wire factors are slightly greater than the nearest conduit factor the next larger size conduit must be used.

Example: Find the conduit size for two 400,000-circ.mil wires and one No. 6 wire. Wire factor for two 400,000-circ.mil wires = 1.670 and for one No. 6 wire = 0.132. 1.670 + 0.132 = 1.802. In Table II under Number of Cables 3 the next largest conduit factor is 2.01 and the size conduit is 2½ in. The conduit size selected is incorrect and brings out a special case where a small size wire is installed in a conduit with much larger wires. In this case the wire factor for the two 400,000-circ.mil wires is the governing factor in the selection of the conduit size. The conduit factor for 2½-in. conduit for two wires is 1.53 and the wire factor for two 400,000-circ.mil wires is 1.670, therefore a 3-in. conduit having a wire factor of 2.36 for two wires will be selected.

Not Altruism— Just Good Business

WE ARE just an ordinary business institution. We are in business for the profit we can make out of it. We are not a charitable organization, or a patriotic or an eleemosynary organization, but there is something about this organization that gives us a feeling of affection toward the public we serve. When I walk down the street and see the lights shining in the homes, I have a feeling of pride because I know my company has an interest in every one of those homes and has helped to bring light and happiness and cheerfulness into the homes.

P. S. ARKWRIGHT,
President Georgia Power Company.

TABLE VI—COMBINATION FACTORS FOR 600-VOLT N.E.C. RUBBER-INSULATED WIRE

Size of Wire B. & S. or Circ.Mil.	Diameter of Wire (Outside)	Number of Wires — Wire Factors								
		1	2	3	4	5	6	7	8	9
14	0.20	0.0314	0.0628	0.0942	0.1256	0.177	*0.189	0.220	0.251	0.283
12	0.22	0.0380	0.0760	*0.1140	0.1520	0.190	0.228	0.266	0.304	0.342
10	0.26	0.0491	0.0982	0.1478	*0.1964	0.246	0.300	0.344	0.393	0.442
8	0.29	0.0616	0.1282	*0.1848	0.2464	0.308	0.367	0.431	0.496	0.555
6	0.40	0.132	0.264	0.396	0.528	0.660	*0.792	0.924	1.056	1.188
4	0.45	*0.159	0.318	0.477	0.636	0.795	0.954	1.118	*1.272	1.431
3	0.48	0.181	0.362	0.543	0.724	0.905	1.086	*1.267	1.448	1.629
2	0.51	0.202	0.404	*0.606	0.808	1.010	1.212	1.414	1.616	*1.818
1	0.58	0.264	0.528	0.792	1.056	*1.320	1.584	*1.848	2.112	2.376
0	0.62	0.302	0.604	0.906	1.208	1.510	*1.812	2.114	2.416	2.718
00	0.67	0.354	0.708	1.062	1.416	1.770	2.124	2.478	*2.832	3.186
000	0.72	0.407	0.814	1.221	1.628	2.035	2.442	*2.849	3.256	3.663
0000	0.78	*0.479	0.958	1.437	1.916	2.395	*2.874	3.358	*3.832	4.311
200,000 Circ.mil	0.77	*0.477	0.954	1.431	1.908	2.385	*2.862	3.330	*3.815	4.293
225,000	0.84	0.554	1.108	1.662	2.216	*2.770	3.328	.....	.....	.....
250,000	0.86	0.581	1.162	1.743	2.324	*2.905	3.486	.....	.....	.....
300,000	0.94	0.694	1.388	2.082	2.776	3.470	*4.164	.....	.....	.....
350,000	0.99	0.770	1.440	2.210	*3.080	*3.850	4.620	.....	.....	.....
400,000	1.03	0.835	1.670	2.505	3.340	4.175	*5.010	.....	.....	.....
450,000	1.08	0.916	1.832	2.748	3.664	4.589	5.495	.....	.....	.....
500,000	1.12	0.986	1.972	2.958	3.944	*4.980	5.916	.....	.....	.....
550,000	1.19	1.115	2.230	3.345	4.460	5.575	6.690	.....	.....	.....
600,000	1.23	1.15	2.30	3.45	4.60	5.75	6.90	.....	.....	.....
650,000	1.27	1.27	2.54	3.81	5.08					
700,000	1.30	1.33	2.66	3.99	5.32					
750,000	1.33	1.39	2.78	*4.17	5.56					
800,000	1.36	1.45	2.90	4.35	5.80					
850,000	1.43	1.61	*3.22	4.83	*6.44					
900,000	1.45	1.65	*3.30	4.95	*6.60					
950,000	1.47	1.70	3.40	5.10	6.80					
1,000,000	1.50	1.77	3.44	5.31	7.08					
1,250,000	1.68	2.22	4.44	6.66	8.88					
1,500,000	1.78	2.49	4.98	7.47	9.96					
1,750,000	1.92	2.90	5.80	*8.70	*11.60					
2,000,000	2.00	3.14	6.28	9.42	12.56					

*Wire factors which when used for selecting conduit sizes give sizes that do not agree with N.E.C. table.

READERS' FORUM

Experience Gained in Use of Ground Chain

To the Editor of the ELECTRICAL WORLD:

Apropos of what what was said in the November 2 and November 30 issues of the ELECTRICAL WORLD in regard to the use of ground chains for the protection of men while working on transmission lines, I think it is in order to relate the very recent experience which we have had in this connection.

One of our line crews was performing some work on a 13.2-kv. circuit, which was constructed in vertical configuration on the same poles with a 66-kv. line. The 66-kv. line was not taken out of service during the time that work was being done on the 13.2-kv. line. As protection for the men, clamp type sticks, which were connected together with sections of galvanized steel chain, were attached to each of the three conductors on the 13.2-kv. line. Another section of the same sort of chain connected one of the sticks with the vertical ground lead coming down the pole for a connection to earth. A wood plank platform was arranged under the wires to facilitate the work which was to be performed. One man, in walking along this platform, took hold of the wires in an effort to aid his balance and for a moment had hold of two different phase wires at the same time. When he did this he received a shock (from the electrostatic voltage induced by the adjacent 66-kv. circuit), the effect of which was that the man lost his balance and fell to the ground, injuring himself quite severely, although, fortunately, not seriously. The first explanation for the shock was that the ground connection was of too high resistance. After considering, however, that the man received his shock by contact with two conductors and, apparently, not by potential to ground, the protective value of the ground chain itself was questioned. The chain was brought into the laboratory and was found to be partially rusted.

The resistance of a section of the ground chain equal to the length of section connecting two different wires in the case which I have just cited (about 42 in.) was measured by means of a Wheatstone bridge and was found to be beyond the capacity of the instrument, which was 10 megohms. This held true even when the chain was put under about 50 lb. tension by having men at opposite ends pull on the chain as hard as they could. The chain was then put under high-voltage test and it was found that this same length of section broke down at approximately 8,000 volts. Later there was applied to the chain a potential of 2,000 volts for two minutes, then 4,000 volts for two minutes, then 5,000 volts for two minutes, and the voltage was being raised to 6,000 when it broke down.

For the sake of comparison, another section of grounding chain, also of galvanized steel (the links, however, being larger than in the chain previously tested) but in quite good condition as regards rust or corrosion, was put under test and a section of this chain (42 in. long) was found to have a resistance of approximately 360 ohms when hanging slack and 0.6 ohm when drawn up to about 50 lb. tension in the same manner that the other chain had been drawn up.

The above tests indicated to us conclusively that chain used for protection applications during transmission line work must be pulled taut in order to be of value and, furthermore, must be perfectly clean.

E. F. DeTURK,
Assistant Superintendent Transmission and Distribution.
Metropolitan Edison Company, Reading Division,
Associated Gas & Electric System.

* * * *

Confusion Regarding Breaker Ratings Should Be Removed

To the Editor of the ELECTRICAL WORLD:

I am very much interested in your October 19 editorial on "Short-Time Ratings of Oil Breakers" and the comments of H. R. Woodrow (November 9) and R. M. Spurck (November 30).

The A.I.E.E. definition, 19-108, is far from clear. It calls for one rating for apparently an infinitely small duration of time. Manufacturers give their breakers two ratings, called 1-second and 5-second, which in no way correspond. The rule apparently refers to withstanding inrush current when the breaker is closed and this has been broadly construed by some that the breaker must be capable of closure on currents up to its 1-second rating. The 5-second rating given to an oil breaker is distinctly a thermal rating. With the exception of a very few old breakers which have an electromagnetic limitation even below the 5-second rating, this rating is fifty times the normal current-carrying capacity and is a measure of the thermal capacity of the breaker. As a thermal rating it is possible to derive the rating at other durations by considering the heating proportional to time and the square of the current. Thus, for a 100-amp. breaker the following ratings could be derived based on thermal capacity only:

Normal	Rating				
Amps.	5-Second	1-Second	10-Second	30-Second	1-Minute
100	5,000	11,100	3,400	2,000	1,440

The manufacturer's 1-second rating is not a 1-second thermal rating at all. It is an expression of the electromagnetic limitation of the breaker and has little or no relation to duration of time. If it were a thermal limit, the 1-second rating would be approximately 111 times the normal current capacity, but as far as I know there are no ratings that high. Quite often the rating corresponds to 2 or 3-second ratings, and where the 1-second and 5-second ratings are the same it is quite apparent that it is a 5-second rating and not a 1-second rating in any way.

The present confusion that exists both in rating and suitability of design for high inrush currents should in some way be corrected.

J. D. WOOD,
Assistant Chief Engineer.
Roller-Smith Company,
New York City.

Men of the Industry

G. A. Rust Elected to Vice-Presidency

GEORGE A. RUST has been elected vice-president in charge of purchasing for Charles H. Tenney & Company, with headquarters at Boston, Mass. He has been in the employ of the Tenney

organization since 1905 and has been engaged in purchase activities during the entire period, having lately been serving as purchasing agent.

Mr. Rust's earlier career included a term of service with the General Electric Company. He is a past-president of the New England Purchasing Agents' Association and was one of the organizers of the public utility group of the National Association of Purchasing Agents, having served as its chairman.

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WILLIAM S. SCHMIDT has been appointed assistant general superintendent of the electrical department of the Pennsylvania-Ohio Power & Light Company and the Pennsylvania Power Company. Mr. Schmidt was graduated from Cornell University in electrical engineering in 1920, was with the Westinghouse Electric & Manufacturing Company in the control engineering department at East Pittsburgh for a year and then went with the Penn Public Service Company at Johnstown, Pa. He joined the Penn-Ohio organization as assistant electrical engineer in 1926.

ALEXANDER D. ROBB has been appointed vice-president of the Niagara Electric Service Corporation, Niagara Falls, N. Y. Mr. Robb has been connected with the public utility industry for 25 years.

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DONALD L. CASH, commercial manager of the Rockford (Ill.) Electric Company for seven years, has been appointed Southern commercial manager in Atlanta, Ga., for the Central Public Service Corporation.

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CHARLES E. WILSON, formerly assistant to the vice-president, has been named manager of the merchandise department of the General Electric Company, Bridgeport, Conn., according to an announcement by Vice-President C. E. Patterson. Mr. Wilson, who succeeds the late H. C. Houck as manager, will continue to have supervision of manufacturing, engineering and sales activities of the department.

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WILLIAM A. SAUER, who has been elected vice-president and general manager of the Midland United Company, has been associated with that company and the Midland Utilities Company since their organization. He was elected comptroller of the Midland Utilities Company in 1923 and in 1928 was elected vice-president as well. When the Midland United Company was organized at the beginning of 1929, he was elected vice-president and comptroller of that company. Mr. Sauer also is a vice-president of the Peoples Gas Light & Coke Company of Chicago.

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JOHN M. COSTELLO and HARRY B. ZIMMERMAN have been elected assistant vice-presidents of the Buffalo, Niagara & Eastern Power Corporation. Mr. Costello has been executive manager for the eastern division of Niagara, Lockport & Ontario Power Company for a number of years. Before that time he was district manager in practically every district of the company, starting from a position in the stores department. Mr. Costello is chairman of the rural electrification committee of the Empire State Gas & Electric Association. Mr. Zimmerman has for several years been executive manager for Niagara, Lockport & Ontario Power Company in Cattaraugus and Chautauqua counties. He has had a great deal of experience with this and other companies in the operation, not only of electric light and power properties, but street railway properties as well. He started with Niagara, Lockport & Ontario Power Company as sales engineer in the Chautauqua division.

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H. H. Bodge Sales Manager of New England Companies

HAROLD H. BODGE, who recently was appointed sales manager of the Fall River (Mass.) Electric Light Company, Attleboro Steam & Electric Company, Tiverton Electric Light Company and Seekonk Electric Company, all these being properties of the New England Power Association, is widely known in New England power engineering circles.

Mr. Bodge is a native of Maine, and after being graduated in electrical engineering from Tufts College in 1905 he spent four years at the Schenectady

works of the General Electric Company. He was then transferred to the Boston office and for fifteen years was occupied in switchboard and apparatus sales. In February, 1925, he was appointed power sales engineer of the Fall River company, holding this position until his recent promotion. His success in the field of large power sales has been notable and in this line of endeavor he is a recognized authority.

J. J. Gibson Vice-President Westinghouse Supply Company

JOHN J. GIBSON, who was elected vice-president and a director of the Westinghouse Electric Supply Company, as announced recently in the ELECTRICAL

WORLD, entered upon his career in the shops of the Westinghouse Electric & Manufacturing Company in 1894. After spending a year in this work he affiliated himself with the American Telephone & Telegraph Company, first as inspector in New York and later as district manager in Norfolk, Va. Following the occupancy of the managership of the Southern Bell Telephone & Telegraph Company, both at Richmond and Norfolk, he joined the Westinghouse Electric & Manufacturing Company in Chicago as salesman. From 1905 to 1914 he served as district manager at Philadelphia, subsequently becoming manager of the supply department in East Pittsburgh. Before his election to his present position with the Westinghouse Electric Supply Company he was vice-president and a director of the Westinghouse Commercial Investment Company, New York, having occupied that office since 1922. Mr. Gibson is a native of York, Pa., and a graduate electrical engineer of Lehigh University. He is a fellow of the American Institute of Electrical Engineers and a member of the Franklin Institute.

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LORD CHURSTON has been appointed deputy-chairman of Insull Son & Company, Ltd., a British company owned by Insull Utilities Investment, Inc., of America. The English company is the sole European agent for the distribution of the securities of the various companies controlled by Samuel Insull and his associates, and it has opened offices in London.

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J. E. GOODALE, formerly assistant electrical engineer of the New York & Queens Electric Light & Power Company, Long Island City, N. Y., has been appointed electrical engineer in charge of the engineering department. Mr. Goodale has been with the New York & Queens organization since his graduation from Brooklyn Polytechnic Institute in 1919, having been in charge of the General Engineering Bureau before his appointment as assistant electrical engineer.

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W. A. King of Youngstown Assigned to Broader Duties

WILLIAM A. KING has been appointed general superintendent of the electrical department of the Pennsylvania-Ohio Power & Light Company and the Pennsylvania Power Company, to succeed Frank W. Funk, who has resigned to assume new duties in Jackson, Mich., with Stevens & Wood. Mr. King became identified with the Penn-Ohio system a year ago, removing from Flint, Mich., after sixteen years of

service with the Consumers Power Company. Starting with the Youngstown utility as superintendent of electrical distribution, he subsequently was promoted to the position of assistant general superintendent and now to that of general superintendent.

OBITUARY

Harry L. Monroe

HARRY L. MONROE, commercial vice-president of the General Electric Company with headquarters in Chicago, died in Dallas, Tex., January 7 in his sixtieth year. Mr. Monroe had been with the General Electric organization for more than 40 years, having started with the Thomson-Houston Company in Chicago in 1888. Four years later, when the Thomson-Houston Company was consolidated with the Edison General Electric Company to form the present General Electric Company, Mr. Monroe was made purchasing agent of the Chicago office.

After spending a short period of time in the Dallas office he returned to Chicago as manager of the railway department of the central district in 1905, becoming district sales manager in 1913 and later district manager. He was elected a vice-president in 1928.

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DEAN R. W. GODDARD of the engineering school of New Mexico Agricultural and Mechanical College was killed December 31 by a charge of 12,000 volts of electricity received while he was doing certain work on the college broadcasting station. Dean Goddard, who designed and built this station, was especially known for the work he had done in connection with the application of electrical apparatus to irrigated farms, studies in connection with the development of the Elephant Butte hydro-electric development, special research on radio, and efforts to establish close relations between engineers of the Southwest and engineers in Old Mexico, in addition to his activities in the educational field.

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R. F. LEEFELD, superintendent of electric generation for the Los Angeles Gas & Electric Corporation, died in that city December 9. A native of Wisconsin, Mr. Leefeld removed to California at an early age and became identified with the utility industry on the Pacific Coast. In the course of his career he was connected with the Temescal Water Company at Corona, Calif.; the Corona Foothill Lemon Company and with the Southern Sierras Power Company. From 1919 to 1921 he served the Arizona Power Company as chief engineer at Clarksdale, and in the summer of 1921 he joined the Los Angeles Gas & Electric Corporation, taking the position he held at the time of his death. Mr. Leefeld was a member of the Pacific Coast Electrical Association.

Financial and Statistical News

CAUTION CONTINUES the watchword in utility financing operations despite the flotation of a $60,000,000 issue said to have been substantially over-subscribed. Few other issues of size have appeared this year to date. The year-end money tightness seems to have slackened and lower money rates are anticipated.

——STOCKS OF ELECTRICAL EQUIPMENT MANUFACTURING COMPANIES listed on the New York Exchange declined more than 43 per cent between September 1 and December 1 last. The figure at the later date was $2,898,804,000 and at December 1 $5,096,095,000.

Fitkin Again on Utility Stage

A. E. FITKIN, investment banker and utility operator, is again in the harness. He announces a general reorganization of the companies under his direction.

A. E. Fitkin & Company, Inc., will be succeeded by Fitkin Securities Corporation, which will own a controlling interest in A. E. Fitkin & Company, Ltd., an investment affiliate, and in United States Engineering Corporation, which, as heretofore, will continue as the engineering and management subsidiary.

The Fitkin group has not been actively interested in any utility properties since it sold the Pacific Public Service Company to the Standard Oil Company of California. Pacific Public Service supplied electricity, gas, water and ice in territory adjacent to San Francisco and in Los Angeles and its suburbs.

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NEW CAPITAL ISSUES

Insull Utility Investments, Inc.

Gold debentures, series B.
Amount, $60,000,000.
Price, 99½ and interest, yielding 6.07 per cent.
Feature, conversion and stock purchase warrants attached.

Insull Utility Investments, Inc., was organized about a year ago to carry on an investment business and to acquire, hold, sell and underwrite securities of all kinds. It now owns, among other securities, substantial blocks of stock of Commonwealth Edison Company, The Peoples Gas Light & Coke Company, Middle West Utilities Company and subsidiaries, Public Service Company of Northern Illinois and the entire capital stock of its subsidiary, Insull, Son &

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Associated Gas & Electric System (Year ended November 30)					
Gross earnings	$85,826,042	$42,000,909	104.0	52	55
Net earnings	41,703,753	18,943,912	120.0	..	..
Carolina Power & Light (Year ended October 31)					
Gross earnings	9,388,222	8,971,770	5.0	46	50
Net earnings	5,085,867	4,511,926	13.0	..	..
Central Illinois Light (Year ended November 30)					
Gross earnings	5,095,010	4,737,699	7.5	58	59
Net earnings	2,123,856	1,934,350	9.8	..	..
Cities Service (Year ended November 30)					
Gross earnings	42,948,476	34,272,956	25.4	..	..
Net earnings	41,650,882	33,115,373	25.8	..	..
Commonwealth & Southern & subs. (Year ended November 30)					
Gross earnings	147,003,575	136,458,433	7.7	49	50
Net earnings	75,256,819	68,746,391	9.5	..	..
Consolidated Gas, Electric Light & Power of Baltimore (Year ended November 30)					
Gross earnings	27,871,045	25,963,474	7.3	58	60
Net earnings	11,736,303	10,522,437	11.5	..	..
Detroit Edison (Year ended November 30)					
Gross earnings	56,534,265	51,853,871	9.0	66	65
Net earnings	19,113,681	17,920,545	6.7	..	..
Eastern Utilities Associates (Year ended November 30)					
Gross earnings	9,316,861	8,522,813	9.3	..	..
Net earnings	3,712,698	3,140,115	18.2	..	..
Kansas City Power & Light (Year ended November 30)					
Gross earnings	$14,537,608	$13,708,580	6.1	51	51
Net earnings	7,118,818	6,720,040	5.9	..	..
New York Power & Light (Year ended November 30)					
Gross earnings	22,203,019	20,338,916	9.2	58	57
Net earnings	9,221,220	8,831,678	4.4	..	..
Public Service Corporation of New Jersey & subs. (Year ended November 30)					
Gross earnings	136,233,125	124,508,951	9.4	69*	71*
Net earnings	41,897,124	35,828,731	16.9	..	..
Southern California Edison (Year ended November 30)					
Gross earnings	39,925,805	34,825,941	15.0	34	33
Net earnings	26,499,237	23,418,352	13.0	..	..
Texas Power & Light (Year ended October 31)					
Gross earnings	9,833,285	9,679,490	2.0	51	53
Net earnings	4,847,677	4,524,410	7.0	..	..
United Light & Power & subs. (Year ended November 30)					
Gross earnings	95,044,527	89,261,236	6.5	58	59
Net earnings	39,688,616	36,895,262	7.6	..	..
Utah Power & Light (Year ended October 31)					
Gross earnings	11,665,346	10,929,500	7.0	50	49
Net earnings	5,792,379	5,599,054	3.0	..	..
Virginia Electric & Power & subs. (Year ended November 30)					
Gross earnings	17,018,194	16,155,804	5.3	..	..
Net earnings	7,648,530	6,947,585	10.1	..	..

*Operating Expenses include depreciation.

Co., Inc. These ten-year 6 per cent debentures will mature January 1, 1940. Each $1,000 debenture will carry a non-detachable warrant whereby the debenture may be surrendered at its principal amount in exchange for common stock of the company and in addition each $1,000 debenture will carry a non-detachable warrant giving the holder of the debenture the unconditional right to purchase ten shares of common stock during the year 1930 at $65 per share. Proceeds of this financing will furnish sufficient funds to pay off all current indebtedness and acquire all securities now contracted for, and will provide the company with a substantial cash sum.

Sioux City Gas & Electric Company.
First mortgage 5 per cent gold bonds.
Amount, $1,000,000.
Price, 93 and accrued interest, to yield over 5.45 per cent.

Sioux City Gas & Electric Company does the entire electric light and power and gas business in Sioux City, Ia. The first mortgage gold bonds are secured by a direct first mortgage on all of the electric light and power and gas properties now owned by the company. These bonds are senior to $4,838,700 par value of 7 per cent preferred stock and $5,800,000 par value of common stock.

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NEWS BRIEFS

Directors of the Lawrence (Mass.) Gas & Electric Company have declared an extra dividend of $1 per share on the capital stock, par $25.

New York Stock Exchange has authorized the listing of 600,000 additional shares of common stock (no par) of Standard Gas & Electric Company upon official notice of issuance in connection with the acquisition of property of Standard Power & Light Company, making the total amount applied for not to exceed 2,579,435 shares. The 600,000 shares of common stock will be used as part consideration to acquire all the property as an entirety of its subsidiary, Standard Power & Light Corporation.

General Gas & Electric Corporation's stockholders at a special meeting approved a five-for-one split-up of the class A and class B stocks.

Central Hudson Gas & Electric Company has filed notice in Albany, N. Y., of an increase in its authorized capital stock from 500,000 to 1,600,000 shares, consisting of 100,000 shares of $100 par preferred stock and 1,500,000 shares of no-par common stock. The increase is part of a plan whereby the Niagara Hudson Power Corporation is to acquire about 25 per cent of the outstanding stock of the company.

Commonwealth & Southern Simplifies Capital Set-Up

THE boards of directors of the Allied Power & Light Corporation, Commonwealth Power Corporation, Penn-Ohio Edison Company, Southeastern Power & Light Company and the Commonwealth & Southern Corporation have approved of a plan of merger and consolidation which, when completed, will result in the acquisition by the Commonwealth & Southern Corporation of all of the assets and the assumption of all of the liabilities of these companies and the issue by the Commonwealth & Southern Corporation of its preferred stock, $6 series, common stock, option warrants and scrip in exchange and substitution for the outstanding preferred stock, common stock, option warrants and scrip of the other companies named.

At present the Commonwealth & Southern Corporation owns more than 96 per cent of the common stock of Commonwealth Power Corporation, Penn-Ohio Edison Company and Southeastern Power & Light Company respectively, and these companies, in turn, own substantially all of the common stock of the various operating public utility companies comprising the Commonwealth & Southern System. The great advantage of uniting all these corporations into the Commonwealth & Southern Corporation is, first, that it will greatly simplify the corporate structure of the Commonwealth & Southern System by eliminating the intermediate holding companies and, second, that it will give the Commonwealth & Southern System a unified, supervision, engineering and construction organization.

All outstanding common stock and warrants of the four companies to be acquired will be exchanged for common stock and warrants of Commonwealth & Southern, while all preferred stocks outstanding will be exchanged for $6 series preferred stock of Commonwealth & Southern, as follows:

For Each Share or Warrant of:	There Will Be Received from Commonwealth & Southern		
	Pfd. Shs.	Com. Shs.	Opt. Warr.
Allied Power & Light:			
1st pfd. $5 ser.	⅛	..	..
Pref. $3 ser.	½	..	..
Common	..	2½	1¼
Commonwealth Power:			
6% cum. pfd.	1	..	..
Common	..	8	4
Penn.-Ohio Ed.:			
7% cum. pr. pf.	1⅛	..	..
$6 cum. pfd.	1	..	..
Common	..	3½	1¾
Op. war. ser. A	..	2½	1¼
Op. war. ser. B	..	¾	⅜
Southeastern:			
$7 cum. pfd.	1⅛	..	..
$6 cum. pfd.	1	..	..
Cum. part. pfd.	1	..	..
Common	..	4½	2¼
Op. warrant	..	2	1

Upon acquisition of all common and preferred stocks and warrants of the other companies by Commonwealth & Southern, it is proposed to liquidate them, leaving a single holding company with the following principal subsidiaries:

Consumers Power, Tennessee Electric Power, Central Illinois Light, Southern Indiana Gas & Electric, Illinois Power, Ohio Edison, Ilinois Electric Power, Southern Michigan Light & Power, Alabama Power, Georgia Power, Gulf Power, Mississippi Power, South Carolina Power, Columbus Electric & Power, Pennsylvania-Ohio Power & Light, Pennsylvania Power, Ohio River Edison, Pennsylvania-Ohio Public Service, Northern Ohio Power & Light, Stevens & Wood, Inc.

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Further New Construction Budgets Announced

FOR 1930 IT IS EXPECTED that the gross construction expenditures of the Detroit Edison Company will approximate $27,000,000, as compared with $36,000,000 for 1929 and $28,000,000 for 1928. The greater size of the 1929 budget is accounted for by the fact that this was a year of major additions to generating capacity, three 50,000-kw. turbines having been added to the system. Nineteen-thirty will see only one such installation and the greater part of the budget will be spread out over the whole system in terms of overhead and underground lines, substations and other building construction.

The principal addition to generating capacity will be a new 50,000-kw. turbine at the Marysville generating station. About half a million dollars will be expended at Delray No. 3 to add the finishing touches to the two units now installed in this plant. This expenditure will include a third 4,000-kw. direct-current house service turbine and an addition to the boiler house to accommodate two more boilers. Another item is the installation of the experimental 10,000-kw. high-temperature turbine of English manufacture. This machine is expected to reach Detroit in April or May and will probably be installed at Delray No. 3. At Trenton Channel turning engines are to be added to the main turbo units for slow cooling of turbine rotors after shutdown. At the Connors Creek plant about $3,000,000 will be spent on an outdoor switch house which will take over the duty of the switching equipment now installed in

the plant. Plans are under discussion for means of ash disposal at Trenton Channel. One proposal in this discussion is the building of a plant to convert the ash into salable byproducts. The total cost of all work to be undertaken at the power plants will be somewhat over $6,000,000.

Substation construction and rehabilitation will be a large part of the 1930 budget. Two large cathedral type substations which will cost nearly $2,000,000 are now under way in Detroit. Four or five substation rebuilding projects are also in hand or contemplated.

Southern California Edison Company budget of new construction expenditures for the year 1930 will total $23,601,058, according to R. H. Ballard, president of the company. The construction budget for the coming year is approximately $5,500,000 greater than expenditures for similar purposes in 1929.

"The Edison company in 1930 will begin the second year of a definite five-year program of intensive development," Ballard said, "and its expenditures for construction of additional service facilities in the ten counties of Southern and Central California will provide principally for extensions and reinforcements to care for an increase of approximately 15 per cent in the connected load of our consumers. A little over $18,000,000 of the total budget will be required for these new business expenditures in anticipation of connecting up 35,000 new consumers during the coming year with an aggregate connected load of 365,000 hp. on the consumers' premises."

The directors of Puget Sound Power & Light Company, a subsidiary of Engineers Public Service Company, have approved a construction budget for 1930 of over $12,000,000. This large addition to plant is necessary to meet the rapid increase in the demand for electric service in the Puget Sound territory.

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Paris Gets 220-Kv. Power

IN ORDER to provide for the ever-increasing demand for power supply in the Paris district the Société Union d'Electricité, which in addition to its own power station is already taking supplies from the hydro-electric power stations at Eguzon and Coindre of the Société de l'Union Hydro-électrique and the Paris-Orleans Railway Company is, in conjunction with the two other electricity supply undertakings in Paris, making similar arrangements with other hydro-electric undertakings.

As a result it is estimated that by the early part of 1933 the three companies will be able to rely in the winter months on 200,000 kw. from the plants in central France, this being transmitted by two main 220,000-volt transmission lines.

Standard Power Stockholders Ratify Reorganization Plan

New boards of directors of both Standard Power & Light and Standard Gas & Electric were elected at a meeting of stockholders held in Dover, Del., January 7, when the reorganization plan, discussed in the January 4 issue of the ELECTRICAL WORLD, was approved. The action taken at the two meetings ratifies the arrangement whereby H. M. Byllesby & Company and the United States Electric Power Corporation will jointly share control of the Standard public utility system.

Louis H. Seagrave, chairman of the board of the United States Electric Power Corporation, was elected chairman of the board of the Standard Power & Light Corporation and Victor Emanuel, president of the United States Electric Power Corporation, was elected president of Standard Power. John J. O'Brien will continue as president of Standard Gas & Electric, no changes having been made in the officers of that company. The board of directors of the two companies consists of:

Standard Gas & Electric

Arthur C. Allyn	U. S. Electric
J. H. Briggs	H. M. Byllesby
Victor Emanuel	U. S. Electric
Halford Erickson	H. M. Byllesby
C. L. Fisher	U. S. Electric
H. W. Fuller	H. M. Byllesby
Robert J. Graf	H. M. Byllesby
E. Carleton Granbery	U. S. Electric
William C. Langel	U. S. Electric
B. W. Lynch	H. M. Byllesby
M. A. Morrison	H. M. Byllesby
John J. O'Brien	H. M. Byllesby
Royal E. T. Riggs	U. S. Electric
Moritz Rosenthal	Ladenburg-Thalmann
Louis H. Seagrave	U. S. Electric

Standard Power & Light

Arthur C. Allyn	U. S. Electric
J. H. Briggs	H. M. Byllesby
H. C. Cummins	H. M. Byllesby
Chester Dale	U. S. Electric
Victor Emanuel	U. S. Electric
C. L. Fisher	U. S. Electric
Robert J. Graf	H. M. Byllesby
E. Carleton Granbery	U. S. Electric
C. C. Levis	H. M. Byllesby
B. W. Lynch	H. M. Byllesby
M. A. Morrison	H. M. Byllesby
John J. O'Brien	H. M. Byllesby
Thomas A. O'Hara	U. S. Electric
Royal E. T. Riggs	U. S. Electric
Louis H. Seagrave	U. S. Electric

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Recent Listings

New York Stock Exchange has authorized the listing of additional general and refunding mortgage gold bonds, series A, 5 per cent, of the Detroit Edison Company to the amount of $13,516,000, making the total amount of general and refunding mortgage gold bonds applied for series A $26,016,000, series B $23,000,000 and series C $20,000,000. There has also been authorized the listing of additional refunding and first mortgage gold bonds, 5 per cent series B, of the Milwaukee Electric Railway & Light Company, totaling $10,000,000, making the total amount of this series of bonds applied for $49,119,000. There have also been authorized for listing on the big board 30,000 additional shares of class A stock (no par value) of the Utilities Power & Light Corporation on official notice of issuance and payment in full by sale to stockholders in lieu of cash dividend.

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Southern California Edison Offers Rights

Rights to subscribe to additional common stock of the Southern California Edison Company were voted at a directors' meeting held December 28. Common-stock holders will be offered the privilege of subscribing to one additional share at $25 for every ten shares held as of February 28. Rights will expire April 21.

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Industrial Power Census Planned

A compilation by industries showing the rate of increase in the use of central-station power is being considered by the electrical division of the Department of Commerce. Such a survey has been made possible by the decision of the Census Bureau to obtain more complete information on the use of power in the census of manufactures for 1929.

Provision is also made for finding out the first time the amount actually expended each year for power. Efforts are being made to segregate more clearly the power produced by manufacturing establishments in their own plants.

After the tabulation has been made of the census returns, it is proposed that the electrical division go over the material and break down the power used by the various industries. It would then be possible to establish ratings showing which of the industrial groups are the most active in substituting central station power for that produced in their own plants, or increasing their power consumption from central stations to the largest extent, and to determine the reasons why some industries maintain their own plants.

Business News and Market Conditions

Radio's 1929 Record

IN VOLUME of sales 1929 was "radio's biggest year," measured in both sets and dollars. Three million nine hundred thousand home receiving sets were sold in 1929, compared with 3,200,000 sets sold in 1928, or an increase of 22 per cent, according to careful estimates just completed by *Radio Retailing* with the aid of industry leaders. In addition to the ordinary radio sets, 218,000 radio-phonograph combinations were sold in 1929, an increase of 150 per cent over the 81,000 sold in 1928. Radio sets and phonograph combinations sold in 1929 totaled a retail value of $549,848,000.

Seventy-one million radio tubes were sold during 1929, with a retail value of $177,500,000. Other accessories and parts brought the total retail value of all home radio sets and equipment sold in 1929 to $805,328,000.

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General Electric Orders Increase 28 Per Cent

ORDERS RECEIVED by the General Electric Company during the year 1929 amounted to $445,802,519, compared with $348,848,512 for 1928, an increase of 28 per cent, President Gerard Swope has announced.

The orders for the fourth quarter of 1929 amounted to $108,398,049, compared with $88,162,049 for the last quarter of 1928, an increase of 23 per cent.

Electrical Exports Up 45 per Cent

EXPORTS OF electrical equipment from the United States during the month of October increased approximately 45 per cent over October a year ago to a total of $14,919,904.

Exports for the year, according to present indications, will exceed $150,000,000, which is the largest yearly total on record and will place the United States first in exports of these products. The total for the ten months ended October 31 was $123,582,531, against $89,622,297 for the ten months ended October last year. This is an increase of approximately 38 per cent.

Outstanding increases for the ten

EXPORTS OF ELECTRICAL EQUIPMENT (PRELIMINARY)

Article	October 1928	October 1929
Generators:		
Direct current—		
Under 500 kw.	$110,240	$113,518
500 kw. and over	30,109	97,279
Alternating current—		
Under 2,000 kv.-amp.	33,228	16,087
2,000 kv.-amp. and over	47,780	7,091
Steam turbo-generator sets	147,156	168,814
Accessories and parts of generators	126,488	82,720
Self-contained lighting outfits	80,804	139,746
Batteries:		
Flashlight batteries	221,191	314,135
Other dry and wet cell primary batteries	238,355	.....
Radio B and C batteries (dry)	.....	76,141
Other, n.e.s.	.....	146,084
Storage batteries	353,748	301,245
Transforming or converting apparatus:		
Power transformers, 500 kv.-amp. and over	156,154	87,074
Distribution transformers, less than 500 kv.-amp.	87,090	173,631
Instrument transformers	1,415	33,957
Other transformers, n.e.s.	101,179	135,612
Complete battery chargers under 15 amp.	29,011	19,752
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	68,289	142,204
Transmission and distribution apparatus:		
Switchboard panels, except telephone	82,325	114,554
Switches, and circuit breakers over 10 amp.	187,143	210,360
Fuses and fuse blocks	45,057	51,975
Watt-hour and other measuring meters	93,399	116,027
Electrical indicating instruments	54,833	55,829
Electrical recording instruments	14,176	27,324
Other electrical testing apparatus	94,591	83,617
Lightning arresters, choke coils, reactors, and other protective devices	77,455	111,523
Motors, starters, and controllers:		
Motors, ¼ horsepower and under	197,496	244,141
Motors, over ¼ and under 1 horsepower	71,229	57,236
Stationary motors—		
1 to 200 horsepower	$259,755	$311,945
Over 200 horsepower	34,116	40,702
Railway motors	17,455	3,558
Electric locomotives—		
Railway	11,622	21,164
Mining and industrial	17,149	77,696
Station and warehouse motor trucks	6,316	42,569
Starting and controlling equipment—		
For industrial motors	150,611	173,834
For electric railway and vehicle motors	7,482	10,670
Portable electric tools	108,983	.....
Portable electric tools, except automotive	.....	89,420
Automotive electric machine tools	.....	4,306
Accessories and parts for motors	233,004	376,979
Electric appliances:		
Electric fans	53,451	120,104
Electric Lamps—		
Metal filament	175,291	137,304
Other electric lamps	62,903	65,613
Flashlights	178,606	215,541
Searchlights and projectors	60,453	75,981
Motor-driven household devices—		
Electric household washing machines	168,165	238,496
Electric vacuum cleaners	120,479	175,700
Other motor-driven devices, except tools	55,207	83,221
Electric flatirons	44,896	28,377
Electric cooking ranges	20,572	28,330
Other domestic heating and cooking devices	89,302	105,975
Industrial electric furnaces and ovens	97,360	40,657
Therapeutic apparatus, x-ray machines, galvanic and faradic batteries, etc	135,841	190,549
Signal and communication devices:		
Radio apparatus—		
Transmitting sets and parts	80,522	135,973
Receiving sets	628,692	1,568,390
Tubes	115,103	219,712
Receiving-set components	363,204	867,671
Other receiving-set accessories	326,449	.....
Loudspeakers	.....	341,743
Other receiving-set accessories	.....	584,496
Signal and communication devices (con.):		
Telegraph apparatus	$112,622	$117,690
Telephone apparatus—		
Telephone instruments	43,160	124,943
Telephone switchboards	40,789	90,272
Other telephone equipment	163,356	395,571
Railway signals, switches and attachments	65,047	79,753
Bells, buzzers, annunciators, and alarms	20,636	39,841
Other electric apparatus:		
Spark plugs	123,843	105,806
Other starting, lighting, and ignition equipment	58,507	203,506
Insulating material	162,510	132,158
Metal conduit, outlet, and switch boxes	131,816	135,892
Sockets, receptacles and lighting switches	152,824	164,757
Electric interior lighting fixtures	191,724	229,639
Electric street lighting fixtures	82,874	53,128
Other wiring supplies and line material	105,713	123,473
Other electrical apparatus, n.e.s.	746,097	1,207,561
Rubber and friction tape	49,923	32,086
Globes and shades for lighting fixtures	60,510	76,851
Electrical glassware except for lighting	53,044	37,681
Electrical porcelain:		
For less than 6,600 volts	40,956	112,154
For 6,600 volts and over	62,102	103,643
Carbons, carbon brushes, and electrodes:		
Electrodes for electric furnaces	168,043	202,552
Other carbon products	52,497	64,657
Insulated iron or steel wire and cable	19,871	22,703
Copper, bare wire	326,123	193,464
Copper, insulated wire and cable	438,273	470,352
Refrigeration sets up to 1 ton capacity	444,940	.....
Refrigeration sets up to ¼ ton capacity	.....	806,644
Refrigeration sets over ¼ to 1 ton capacity	.....	88,675
Totals	$10,311,530	$14,919,904
Ten months ended Oct. 31	$89,622,297	$123,582,531

months period were made in distribution transformers and rectifiers, switches, electrical recording instruments, lightning arresters, motors and many classes of electrical appliances. Radio apparatus was also responsible for a very large proportion of the gain.

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Installment Losses Slight

LOSSES ON INSTALLMENT SALES during the past year were exceedingly small, according to an investigation just completed by the Domestic Commerce Division of the Bureau of Foreign and Domestic Commerce. Returns were received from 212 electrical appliance stores representing stores of all sizes and all geographic sections of the country. The average loss was 1.5 per cent. Half of the stores showed losses of less than 0.2 per cent, but a number had losses of over 5 per cent. No estimate of loss due to repossession alone is available.

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Westinghouse Receives New Orders

AN ORDER for automatic switching equipment for control of one 500-kw. railway converter was recently awarded the Westinghouse Electric & Manufacturing Company by the Clinton, Davenport & Muscatine Railway Company of Davenport, Iowa.

Pennsylvania Power & Light Company, through the Phoenix Utility Company, recently awarded the Westinghouse Company orders for eight weatherproof outdoor switch houses and two indoor units.

Erie Railroad has ordered a 600-hp. oil-electric rail car, the body of which will be built by the St. Louis Car Company.

West Penn Power Company has placed an order for a 250-watt duplex carrier current set for use in the Lake Lynn hydro station, located on the Cheat River in Pennsylvania. This equipment when installed will provide power line communication with the existing Westinghouse type carrier current sets at Cumberland and Williamsport on the Potomac Edison Company system.

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New York Metal Market Prices

	Dec. 31, 1929 Cents per Pound	Jan. 8, 1930 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6.25	6.25
Antimony	8½	8¾ (spot)
Nickel, ingot	35	35
Zinc, spots	5.80	5.60
Tin, straits	39¼	39½
Aluminum, 99 per cent	24.30	24.30

Market Conditions

THE ELECTRICAL equipment market in the East has developed increased strength and present demands forecast a revival, particularly in the heavy equipment field. In the Middle West the lull which characterized the closing months of 1929 is now over and business seems to have revived considerably.

——STOCK TAKING BY THE Pacific Coast jobbers reveals that business in that section of the country is in a good condition. It is reported that prices are steady following the retail spurt during the holiday season.

——METER AND DISTRIBUTION TRANSFORMER orders are noted in the slightly improving volume of business in the Southeast. Heavy equipment orders are slow in coming in the New England district.

EASTERN

—THERE IS A HEALTHY *tone in the electrical equipment market in the Eastern district. Central station account is developing increasing strength not only with respect to actual commitments but in volume of inquiries; the beginning of 1930 expansion programs is showing its effect.*

—INDUSTRIAL DEMAND *gives early promise of revival, particularly in connection with heavy equipment for steel mills.*

—JOBBERS OF ELECTRICAL APPARATUS *and supplies report trade as slow, and retail demand is inclined in the same direction.*

Structural steel has registered a notable quota of orders for electric construction enterprises during the week. The Milwaukee Electric Railway & Light Company has placed a contract for steel framework for a power plant addition; the Public Service Company of Northern Illinois has ordered steel framing requirements for a power plant; Granite Falls, Minn., has given an award for steel work for a power plant addition. The Pennsylvania Railroad Company has contracted for a heavy quantity of steel for its electrification program at West Philadelphia, and on the main line between New York and Trenton. The Edison Electric Illuminating Company, Boston, has inquiries out for structural steel for a new operating building, and other similar awards are pending.

This expansion in construction operations is reflected in improved demand for electrical equipment and the call is more varied than for several weeks past. A central station in Texas has ordered a turbo-generator unit and accessory equipment from a New York manufacturer, to cost $450,000, and has contracted for another smaller such unit from the same maker at a price of $250,000. A power company in central New York has given an award to a state manufacturer for switching equipment, transformers and affiliated apparatus to cost $150,000. An electric utility company in Indiana has ordered a quantity of wire and cable from a New York producer, costing about $45,000. A metropolitan central station has contracted with a local manufacturer for switchgear and affiliated equipment to an amount of $40,000. A manufacturer of air circuit breakers and kindred apparatus reports business as excellent, with sizable bookings over entire line of specialties, including an important order from a metropolitan power company. A maker of transformers in New Jersey says that trade is well distributed and that inquiries are maturing in increasing volume; radio account, only, has fallen off in the past few weeks; excellent spring business is anticipated.

A manufacturer of electrical equipment for automobile service in Ohio is running on a capacity schedule and has secured an order for car generators from a leading automobile maker which will insure this basis of output for the entire year. A maker of heavy cable for transmission line service says that orders are developing in satisfactory volume, and that demand is better than at this time last year. Electric refrigerator business shows expanding tendencies and sizable orders are anticipated within sixty days. Street-lighting equipment is inclined to be a little slow, but airport lighting apparatus is active.

CONSTRUCTION PROJECTS

Peoples' Light & Power Company, New York, contemplates a hydro-electric power plant in Virginia, to cost more than $1,000,000. Rubel Ice & Coal Corporation, Brooklyn, N. Y., contemplates a multi-story cold

storage and refrigerating plant to cost $300,000. Buffalo General Electric Company, Buffalo, N. Y., has filed plans for a power substation. Department of Sanitation, New York, plans group of garbage disposal plants to cost about $30,000,000, including motor truck repair and garage buildings. Department of Water Supply, Gas & Electricity, New York, has plans for an equipment storage and distributing plant at West New Brighton, S. I., to cost $450,000. Penick & Ford, Inc., New York, plan extensions and improvements in syrup plant at Harvey, La., reported to cost more than $100,000. Philadelphia Electric Company, Philadelphia, Pa., will build an addition to Powelton substation and new substation in northeastern part of city, reported to cost more than $500,000. Wolverine-Empire Refining Company, Oil City, Pa., plans expansion program at oil refineries to cost over $100,000. Sellmayer Packing Company, Baltimore, Md., will soon take bids for a cold storage and refrigerating plant to cost $175,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until February 26 for refrigerating plant for the naval operating base, Pearl Harbor, T.H. (Specification 6005.)

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SOUTHEAST

—BUSINESS IN ELECTRICAL FIELD *in the Southeast is picking up, the volume of small orders being sustained and the number of large orders on the increase.*

—POWER TRANSFORMERS *amounting to approximately $22,000 were ordered for the Atkinson steam plant in Georgia.*

One company's distribution line material orders last week aggregated $9,460, while its house type meter purchases totaled $4,900 and small power and distribution transformer orders amounted to $3,800. A company in Alabama has received bids on two cars of bare and weatherproof copper wire and orders will probably be let this week. An interesting order from North Carolina was for weatherproof copper wire totaling 600,000 lb. to go into a railway signal system. A lumber mill in Louisiana ordered power transformers costing $30,000, while two industrial plants in Alabama each placed an order for motor equipment amounting to $10,000. The small sign field continues to show activity, one agent reporting his small sign orders last week totaling in excess of $4,000.

CONSTRUCTION PROJECTS

Weirton Steel Company, Weirton, W. Va., plans extensions and improvements to cost close to $5,000,000. Owensboro Grain Company, Owensboro, Ky., plans rebuilding of elevator and mill, reported to cost in excess of $125,000. Memphis Power & Light Company, Memphis, Tenn., plans extensions and improvements in local power plant to cost $325,000. Charlotte Coca Cola Company, Charlotte, N. C., has completed plans for a bottling plant to cost $100,000. Southern Public Utilities Company, Charlotte, N. C., plans extensions in transmission lines and distributing system at Boiling Springs, N. C., and vicinity. Florida Power & Light Company, Miami, Fla., will build a transmission line from South Bay to Pahokee, Fla., including substation facilities.

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MIDDLE WEST

—THAT THE YEAR *just closed has been entirely satisfactory is generally admitted in the Middle West section; most lines of industry show a substantial increase in business and the lull most noticeable the last few months of the year is believed to be over.*

—A FEELING OF CONFIDENCE *is generally expressed and the outlook for the first quarter of the year is promising. The major activities are getting under way in good shape with increased production scheduled in the automotive industry.*

—THE RAILROADS *are continuing their placing of equipment and maintenance commitments and the electrical industry is proceeding on a conservative basis, confidently preparing for a normal business year.*

The mild weather has allowed a large amount of construction work to go on and the various utility companies are taking advantage of it to complete line extensions and circuit revisions. Apparatus demand has been somewhat light, although the demand for distribution equipment has been particularly heavy. One interesting order placed this week was for ten high-speed breaker truck equipments, 3,000 amp., 650 volts, valued at $38,000.

Jobbers' sales are somewhat slow, although up to expectations for this period of the year. Inventories are relatively small and a good deal of business is expected to come in this month.

CONSTRUCTION PROJECTS

Kimberly-Clark Company, Neenah, Wis., will soon begin construction of addition to paper mill at Kimberly, Wis., to cost $100,000. Parker Pen Company, Janesville, Wis., plans extensions and improvements to cost $75,000. Waukesha County Board of Supervisors, Waukesha, Wis., plans power plant to cost about $45,000. Allis-Chalmers Manufacturing Company, West Allis, Wis., plans additions to cost more than $2,000,000. Chevrolet Motor Company, Flint, Mich., contemplates additions to plant at Bay City, Mich., reported to cost $100,000. Detroit Die Casting Company, Detroit, Mich., is perfecting plans for an addition to cost about $100,000. Detroit Edison Company, Detroit, Mich., plans extensions and improvements in underground conduits and cable lines to cost $3,000,000. Commonwealth Edison Company, Chicago, Ill., has filed plans for a power substation to cost $80,000. Continental Scale Manufacturing Company, Chicago, Ill., plans addition to cost $125,000. Corman Aircraft Corporation, Connersville, Ind., has plans for a factory and power plant to cost $140,000. South Meridian Motor Inn, Inc., Indianapolis, Ind., plans automobile service, repair and garage building to cost $300,000. Highland Iron & Steel Company, Terre Haute, Ind., has plans for a fabricating plant to cost $100,000. Firestone Battery Company, Akron, Ohio, plans addition to local plant; will also build factory on the Pacific Coast, entire project to cost over $150,000. Franklin Oil & Gas Company, Bedford, Ohio, plans oil works to cost about $100,000. Ozark Smelting & Mining Company, Coffeyville, Kan., operated by the Sherwin-Williams Company, Cleveland, Ohio, will build an addition to lithopone plant to cost $250,000. Duriron Company, Dayton, Ohio, plans machine shop, foundry and other plant units, reported to cost more than $150,000. Pence Automobile Company, St. Paul, Minn., contemplates building for service, distributing, etc., to cost $100,000. Hastings, Neb., plans extensions and improvements in municipal electric light and power plant, including installation of turbo-generator unit, estimated to cost $135,000. Cedar Rapids, Iowa, contemplates an ornamental lighting system.

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NEW ENGLAND

—A QUIET TONE *in buying electrical equipment prevails in this district. Heavy equipment negotiations are marking time.*

—AN ENCOURAGING VIEW *of the coming year in the distribution of electrical equipment is well founded by the increasing number of new projects announced for 1930.*

Small power motors and control equipment sales are steady, though the volume is small and buying is on a conservative basis; during the past week one manufacturer reported that sales of small motors were favorable; in addition inquiries as to deliveries of fractional-horsepower motors were more frequent; control equipment sales, including small switches and wiring accessories, were steady. Recently several 50-hp. motors were placed in an Eastern printing shop. Shoe manufacturers are more active in the market and small control equipment sales in this direction are encouraging. Orders covering over $22,000 for motors and accessories were reported by one manufacturer.

Central-station equipment buying is lagging somewhat but optimism reigns due to recent announcements of substation additions and line extensions in

this area; in southern Massachusetts additions to one substation and construction of two new stations with extension of underground transmission system are announced; in addition, two 2,200-volt stations will be constructed for expanding industrial service. In the northern district announcement of plans for construction of another large hydro-electric station is of interest.

Electrical specialties are in favor and several notable sales are reported; during the past week one prominent company received orders for 42 electric clocks of a well-known make; 123 radio sets were sold through a group of central stations. Electric domestic appliance sales for one central station group exceeded by 60 per cent that volume reported for a corresponding week last year.

CONSTRUCTION PROJECTS

Springfield Ice Company, Springfield, Mass., plans ice-manufacturing plant to cost about $85,000. Norton Company, Worcester, Mass., contemplates extensions and improvements in grinding wheel and grinding machine plants to cost more than $1,000,000. Rhode Island Ice Company, Providence, R. I., plans ice-manufacturing plant reported to cost more than $70,000. Grafton Power Company will construct 9,000-kw. hydro-electric plant near Monroe, N. H.

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PACIFIC COAST

—CALIFORNIA BUILDING CONSTRUCTION *decreased 11 per cent in 1929 under 1928, as evidenced by annual reports from San Francisco and Oakland.*

—ANNUAL JOBBERS' STOCK TAKING *finds coast stocks in very good shape.*

—PRICES ARE STEADY *after a small retail flurry during holiday season. Four feet of snow has accumulated along the Sierras, perhaps one-third of the mean seasonal fall.*

Company business is outstanding for the past week, including such items as $3,000 worth of ⅛-in. double galvanized strand, $5,000 worth of circular mil sizes rubber-covered wire, two carloads of bare copper wire, worth $18,000, $1,500 worth of clevises, six carloads of assorted poles and $1,000 worth of pike poles and cable grips. The outstanding order of this kind covers $30,000 worth of paper and lead cable for the city of Los Angeles. Several orders for high-tension porcelains were placed, including one carload of 11,500-volt insulators for lines and fuse assembly, 2,000 23-kva. pin type insulators valued at $3,000 and $1,500 worth of 2-kva. special tubes.

Machinery orders were excellent during December but slower so far for January. As soon as annual budgets become operative they will produce much machinery business. Westinghouse reports a $35,000 circuit breaker sale for San Francisco and a 15,000-kva. hydrogen-cooled condenser, the first of its type on the coast, in Los Angeles. General Electric reports the sale of switch gear equipment for the Salt Springs power house and a switchboard for the Tiger Creek power house, totaling $110,000. Prospective business includes a $400,000 generating station for San Francisco, $140,000 worth of substations and system betterments in the Imperial Valley, including a 5,000-kva. condenser and a rebuilt 17-kva. line, a $700,000 building for the University of California, first of a new group; a $90,000 street lighting job for Los Angeles, a $1,500,000 hotel for Los Angeles.

The Seattle Board of Public Works desires bids until 10 a.m., February 28 for furnishing machinery and equipment for a hydro-electric power plant of two main generating units, each unit consisting of an alternating-current generator of at least 60,000-kv.-amp. maximum capacity at 90 per cent power factor mounted on a vertical shaft and driven by a reaction type turbine, together with necessary exciter valves, governors and transformers. The city of Seattle purchased a second-hand Westinghouse 10,000-kw. steam turbo-generator for $36,000 for installation in the steam auxiliary at Renton and will open bids this week for furnishing 50,000 lb. of weatherproof solid copper wire for local extensions. Motor sales reported include 25 from 50 hp. down to woodworking plants in Puget Sound district, 1 150-hp. machine and a 24-in. pump for the municipal water system of Tacoma, ten from 25 hp. down to a dealer and about 30 machines from 50 hp. down to scattered mills and industrials. From September 1 to November 30 the combined divisions of the Puget Sound Power & Light Company sold 1,822 electric ranges for residence use, while the city of Seattle during the same period in Seattle alone sold 732. In December the city of Seattle sold 208, but figures for the Puget Sound Power & Light are not available. The city of Centralia will issue bid call shortly for a municipal power plant. A diversion dam and canal costing in excess of $176,000 has been completed and awards for machinery made last August.

CONSTRUCTION PROJECTS

Fokker Aircraft Company, Glendale, W. Va., plans plant at Alhambra, Calif., to cost about $250,000. Long Beach Glass Company, Long Beach, Calif., plans plant to cost more than $75,000. Los Angeles, Newport Beach, San Jose, and Armona, Calif., plan ornamental street-lighting systems. Adohr Creamery Company, Los Angeles, Calif., plans plant to cost about $200,000. Crane Company, Chicago, Ill., manufacturer of plumbing and heating equipment, plans plant at Los Angeles, Calif., reported to cost over $100,000. Mutual Income Properties, Inc., Los Angeles, Calif., has plans for a cold storage and refrigerating plant to cost $1,000,000. Van deKamp's Holland Dutch Bakers, Inc., Los Angeles, Calif., is completing plans for a baking plant to cost $400,000. Ford Motor Company, Detroit, Mich., plans assembling plant at Richmond, Calif., to cost about $750,000. Southern Sierras Power Company, Riverside, Calif., plans power substation and extensions in transmission lines at Elsinore and vicinity, to cost $100,000. Puget Sound Pulp & Paper Company, Everett, Wash., will build a power substation to cost $80,000, service to be furnished by the Puget Sound Power & Light Company. Sunset Copper Company, Index, Wash., plans mill and hydro-electric power plant to cost more than $125,000. Southern Colorado Power Company, Pueblo, Colo., plans transmission line in the vicinity of Florence, Colo. Holbrook, Ariz., plans ornamental lighting system.

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SOUTHWEST

—DURING THE PAST YEAR *in the industrial district of St. Louis there were 80 new industries established and 135 factories made important expansions with an additional investment of nearly $100,000,000.*

—WHILE THE LEAD MINES *of Southeast Missouri are now operating only five days a week they intend starting full time shortly and nothing but optimistic reports come from the different operators.*

During the past week two contracts aggregating $65,000 were let for wire pole line hardware and insulators for the 200-mile automatic signal system being installed by one of the railway systems. The total cost of this installation is to be more than $200,000. One miscellaneous lot of motors for industrial use to cost $500,000 is the only other order reported.

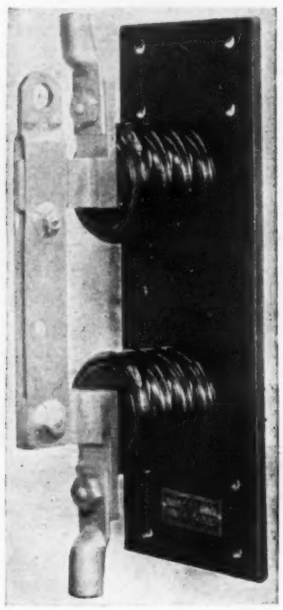
CONSTRUCTION PROJECTS

Eldorado Springs, Mo., plans municipal electric light and power plant reported to cost more than $60,000. Unionville, Mo., plans extensions and improvements in municipal electric light and power plant, Wichita, Kan., plans buildings at municipal airport to cost $200,000. Ozark Reduction Company, Jasper, Ark., plans hydro-electric power plant in connection with lead and zinc reduction mills, entire project to cost more than $1,000,000. Arkansas Power & Light Company, Pine Bluff, Ark., will extend lines in vicinity of Mountain Home, Ark. Galveston Electric Company, Galveston, Tex., plans extensions and improvements in power station and transmission lines to cost about $125,000. Texas Chemical Company, Houston, Tex., plans extensions and improvements in plant to cost about $500,000.

New Equipment Available

Simpler Tongue Type Disconnecting Switch

AN IMPROVED and simpler form of tongue type disconnecting switch has been developed by the Delta-Star Electric Company, Chicago, Ill. The blades



are adjustable and any wear of the contact surfaces can easily be compensated for. The insulator units are interchangeable and the base can be mounted on flat surfaces or on 1¼-in. pipe by means of U-bolts.

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A FUSE PLUG WITH A PYREX GLASS TOP SHAPED AS A LENS, insuring clear vision and magnifying the fuse strip, is announced by the General Electric Company. Since this new fuse plug has a non-metallic insulated top, there are no exposed metal parts when it is inserted in a cut-out. Furthermore, the Pyrex top is tough and does not shatter. The link is inclosed in a deep porcelain cup in which the arc is ruptured.

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GAS-TIGHT INCLOSURES FOR CONDIT AIR MOTOR STARTERS.—The development of a gas-tight inclosing case for its cross-the-line air motor starters, types A-20 and A-30, is announced by the Condit Electrical Manufacturing Corporation of Boston, Mass. The new inclosing case is of strong cast-iron construction. A gasket is provided between the cover and the case. Four heavy eye-bolts and nuts hold the cover tight. The cover is hinged and provision is made for padlocking it closed. Provision is also made for conduit connections at top and bottom. In addition to being gas-tight the inclosing case is dust-tight and weatherproof.

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Auto Transformers with Conduit Connections

A NEW LINE OF AUTO-TRANSFORMERS designed for use on three-phase, four-wire network systems with 199 or 208 volts between phases is announced by the Sorgel Electric Company, 91 West Water Street, Milwaukee, Wis. These transformers are air-cooled and can be installed almost any convenient place inside buildings without a fireproof vault or inclosure of any kind and are stated to meet the requirements of the National Board of Fire Underwriters. They are sold under the trade name "Booster."

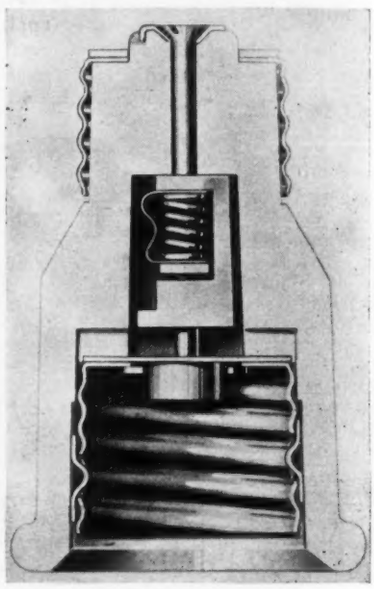
The new transformers are totally inclosed and compact. On account of the small voltage change they are small for their capacity, being equivalent in size to an ordinary two-winding trans-

former of about 10 per cent the capacity, according to the manufacturer.

They are arranged for wall mounting and are provided with supports or brackets designed so that there is the proper space between the transformer and the wall. They may be installed with the terminals either on top or bottom.

Socket Adapter Adjusts Light Distribution

A SOCKET ADAPTER for use in Mogul fixture sockets where there is no adjustment for the difference in the lengths of light centers, viz., 2½ in. between the new and old lamp, is announced by the Line Material Company, South Milwaukee, Wis. The advent of the new 15- and 20-amp. lamps caused considerable difficulty in retaining the original light centers, which is very important where it is desired to



use present reflectors and retain the same lighting distribution.

With this new adapter it is only necessary to take out the old lamp with a 9½-in. light center and screw the adapter into the fixture socket, then screw in the new lamp with a 7-in. light center. The adapter is made in two designs, K98, as shown in the illustration for use with series service, and K97 for use with the multiple socket. The former has a bar across the top of the screw portion of the socket for short circuiting the socket when the lamp is removed and the latter has not.

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ELECTRIC HOISTS WITH ALLOY STEEL GEARING.—A complete line of electric hoists in sizes ranging from ⅛ to 7½ ton capacity is announced by the hoist and crane division of Robbins & Myers, Inc., Springfield, Ohio. A number of outstanding features are claimed by the manufacturer for these new hoists, among which are a radical improvement in design with a resultant saving of weight and space in all dimensions, headroom included, and gearing of alloy steel, heat treated to rigid specifications for greater strength.